

**Learning Efficient Coupling: Enterprise Modernization
Projects as a Domain of Environment-Development
Interaction**

by

Vladislav Balaban

Submitted to the Department of Urban Studies and Plan-
ning in partial fulfillment of the requirements for the
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Author

Department of Urban Studies and Planning

July 31, 1996

Certified by

Professor Emeritus

Department of Urban Studies and Planning

Thesis Supervisor

Accepted by

Frank Levy

Director of the Ph.D. Program

Department of Urban Studies and Planning

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Abstract

This thesis develops the substantive theory about “learning (to achieve) efficient coupling” as a way of organizing thought about the relationship between environment and development and about organizational change. It uses three case studies in the Czech and Slovak Republics to specify this conceptual framework in a concrete setting. These cases, three sets of actions and interactions around industrial modernization development projects, are examined by sociological means of grounded theory procedures in order to provide understanding of how actors in the three industrial modernization projects managed to achieve environmental improvements in a climate of general economic decline. I argue that the project outcomes of efficient couplings are shaped in and emerge out of a field of interaction of the major social actors each inquiring into their own particular problematic situation. Whether or not efficient couplings occur, and what their nature is, depends on the conditions of interaction that hold in a given modernization project and on the processes by which the actors learn in and from a project.

Thesis Supervisor: Donald A. Schon
Title: Professor Emeritus

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Chapter 1

INTRODUCTION

My thesis presents an empirical study of three cases of industrial modernization development projects in the context of interaction between environment and development and of institutional transition in Central and Eastern Europe. These cases, three sets of actions and interactions around industrial modernization development projects, are examined from the perspective of organizational learning in a socio-economic domain of action in order to provide understanding of what learning of efficient coupling on the part of the actors is possible and how it occurs. Consequently, practices conducive to this organizational learning and management are identified as a basis for policy recommendations.

I believe that sustainable development has to be seen as a social problem solving process of policy inquiry (Schon 1971, Lindblom 1990). One way to get insight into sustainable development as policy inquiry is to study how organizations learn in practice (Schon and Argyris 1974) in a socioeconomic domain of action. By organizational learning I understand organizational inquiry which yields new behavior. Not all behavioral change can be explained by learning; some

change is due to other possibilities such as motivation or maturation.

My research is founded on a basic proposition that conditions of interaction in the process of modernization project development and actors' learning in and from the situation significantly influence the emergence of efficient couplings. Efficient coupling is broadly understood as a project design solution which combines environmental improvement with enterprise return to profitability without losses to regional economy in such a way that it achieves a high "mutual effect."

The following research questions are investigated in my research:

What types of productive organizational learning can I find in the situation of the interaction around modernization project development?

What conditions of interaction shaped this learning and the emergence of efficient couplings in the projects?

What sort of efficient couplings have been achieved in these projects?

I interpret activities in my cases as a process of organizational interaction which gives rise to episodes of organizational learning and of efficient coupling between industrial production and environmental quality. Process is conceptualized as a change in conditions of sufficient degree that it brings about a corresponding change in action/interactional strategies which are carried out to maintain, obtain, or achieve some desired end in relation to phenomenon under study (Strauss and Corbin 1990). The phenomenon under study is the modernization project development.

The process of a modernization project development throughout the period of political and economic transition provides a wealth of interactions and organizational processes to study the organizational learning and efficient couplings. The selected projects represent complex significant experiments in environmentally beneficial modernization. Building efficient couplings in the transition process was important for both the financially strapped enterprises and the governments. The transiency of the situation highly increased complexity and uncertainty of the project development.

The organizational change is viewed as driven by the mechanism of policy dialectic: problematic situations give rise to organizational inquiry - problem setting and problem solving - which, in turn, create new problematic situations within which new inconsistencies and incongruities in organizational action theory come into play (Schon and Argyris, 1995).

For example, the cases show that the process of interaction follows a pattern of progressive movement through four evolutionary stages: socialism building stage 1945-1965; socialism reform stage 1965-1989; institutional transition stage 1989-1994; post-transition stage 1994-present. Within these stages, action strategies were adapting to transformations in performance criteria and intermediate objectives brought about by the shifting context. However, the instrumental learning curve in pursuing the strategies became discontinuous - the meaning of what was an improvement shifted in the institutional stages.

Along with the pattern of institutional stages, the process of interaction also shows patterns of growing centrality of green and of technological advance. It also shows changes in a problem specific context such as changing cast of actors, image projecting efforts, problem ownership,

problem attention, technological complexity, financial/economic complexity, and environmental complexity.

These shifting patterns of interaction gave rise to a variety of action strategies and their consequences throughout the different stages of the transformation process in Central and Eastern Europe. These consequences, in turn, could create new problems for the actors. For example, I found a pivotal period when window of opportunity for the efficient coupling between environmental quality and economic improvements occurred most frequently. However, this very way of problem solving, the coupling of environmental and economic benefits in business strategy and technological modernization, created a new range of problems during the next stage of inquiry. In this stage, the achievement of the efficient coupling became vulnerable to unexpected shocks in organizational task environment these two constituted for each other, such as hostile takeovers of enterprises or foreign investor acquisitions.

The types of tasks the actors strove to achieve included bringing in investment, modernizing enterprises, resolving technological design, making profit, and reducing pollution load on the natural environment. Environmental improvement benefits were associated with increased product volume,

decreased consumption of inputs, reduction in pollution and waste disposal charges, increased product price, substitution of inputs, saved pollution abatement costs, improved access to product market, access to capital and reduced capital costs, job maintenance, forward/backward economic linkages, and tax generation.

My findings contribute to the literature on organizational learning and to the literature on sustainable development which currently focuses almost exclusively on technical analysis. I propose that there is a need for a qualitative study that takes into account organizational behavior in relation to various aspects of the institutional environment and change processes under conditions of discontinuity, complexity, uncertainty and the dialectic between problem-setting and problem-solving - conditions prevalent in Central and Eastern Europe.

The outlined analysis of the process of industrial modernization project development suggests formulation of the sustainable development problem in terms of actor learning. It shows that the simple concept of instrumental learning usually utilized in technical studies is complicated by the discontinuity in performance criteria by which action is evaluated. It is further complicated by the occurrence of

problems being reset when intentions are transformed through actions and by solutions creating problems for the next stage of interaction. Seeing the process of sustainable development as a process of non- linear, unbalanced growth and determining which policies and practices are conducive to learning in such a process will help to derive policy recommendations in new ways.

Chapter 2

THE RESEARCH PROBLEM

The following sections explore the research problem as it appears in practice and in research literature. The first section explores the issue from the practice of international development and the perspective of transition in Central and Eastern Europe. The section on literature review surveys some major research formulations in areas of sustainable development and organizational change as they relate to the research problem under consideration.

2.1. The Research Problem in Practice

During the current period of economic reconstruction and transition to democracy, the Central and East European countries must generate sufficient economic resources and clean up the frightening levels of pollution that have accumulated over the past several decades wherever possible. At the same time, they have to prevent causing further environmental degradation when pursuing strategies for economic develop-

ment. The pursuit of this task has the potential for becoming a pursuit of "sustainable development." But governments, development banks, NGO's, industrial enterprises and the task system comprised of them need yet to learn better how to achieve a satisfactory relationship between environment and development.

For instance, we see examples of international financial institutions redesigning their strategies to make them more effective in achieving coupling between environment and economy in their operations. Recently, international development banks have learned to focus on seeking environmentally beneficial investments that can simultaneously support the economic transition. The World Bank (1993) identified "win-win" strategies in energy and water conservation - metering, reducing leakages -, in introducing low- input and low-waste technologies, and in plant improvements which reduce spills, leaks, and material use. The Project Preparation Committee has been pursuing "soft loan" financing by offering subsidy incentives for projects with positive external effects lying outside of the perceived project rational. Subsidy incentives use a variety of forms such as investment grants, guarantees, or interest subsidies (Melzer and Zylicz 1995, Laurson 1995). The Calvert Emerging Europe

Fund for Sustainable Development of the US Oversees Private Investment Corporation, a private equity fund, provides venture capital to support investment opportunities in efficient and clean production technologies, energy industries, and infrastructure development that "meet the needs of the present without compromising the ability of future generations to meet their own needs." Both the European Bank for Reconstruction and Development and the International Finance Corporation condition lending for the restructuring and modernization of industrial enterprises with environmental management action plans.

Because the Central and East European countries are making new investments in industrial modernization and are able to draw on advances in technology and management practices already made in Western industrial countries, they might be able to go straight to low-polluting practices. They need to be aware that while in the past economic growth was associated with severe environmental degradation, the trade-off between development and environment is not always necessary. The key is not to produce less, but to learn to produce differently.

In observing the situation in Central and Eastern Europe, we see that some firms learned to produce differently and

that they managed to make environmental improvements in spite of the general economic decline. How did they manage to improve the environment during the economic decline? How did they overcome in their behavior the decades of total dependence on the central administration to provide themselves with a viable future in the new decentralized economic and political system? What was the nature of the solutions they achieved? These questions provide research puzzles that I hope to answer through my investigation.

2.2. The Research Problem in Literature

In the following sections, aspects of the research problem as they appear in literature on organizational change and on sustainable development are reviewed. These sections assess the literature, review its methodological and conceptual approaches and identify areas for further useful research. This literature review fulfills the four functions identified by Merriam (1991, pp.62-63):

- take into account previous work in the same area;
- interpret and synthesize what has been published and researched in the area of interest;

- assess the work to date and offer suggestions for future inquiry;
- help in the formulation of the problem, in the selection of methodology, and in the interpretation of research results.

In the discussion concluding the review, I argue that the current state of research on environment-development relationship and on organizational learning calls for a practice oriented, qualitative research study.

2.2.1. Perspectives on Sustainable Development

Policy research often treats sustainable development as a technical problem. Policy analysts often strive to formulate it in a relatively value-neutral way, susceptible to specifiable measurements or to deduce it formally as a moral obligation from ethical and legal theories. As Raskin (1993) points out, the discourse on sustainable development usually makes a connection between distributional equity and environmental sustainability within developing countries, within industrialized countries, among countries, and between generations. The following perspectives represent some of the

dominant conventional formulations to researching the policy problem of sustainable development and to providing policy advice for intervention.

Macroeconomic Analysis

Macroeconomic analysis may try to optimize economic growth under the constraint of inter-generational distributional equity (Solow 1991). Sustainable development becomes defined as a problem of intergenerational resource allocation. According to this perspective, we are morally obligated to preserve productive capacity for the indefinite future. It is our moral obligation that we conduct ourselves so that we leave to the future the option or the capacity to be as well off as we are. It is recognized that the obligation cannot be specific; we do not know the tastes, the preferences and the technology of the future generations.

The question of sustainable development then turns into a decision between present consumption, investment and social capital versus future consumption, investment and social capital. In exchange for depleted resources, each generation should add to the social capital in other forms, enough to maintain the aggregate social capital intact.

Sustainability also becomes a question of an appropriate development path for a modern industrial society. As Solow (1992) states, what needs to be preserved is a generalized capacity to produce economic well-being. A sustainable path for the national economy is one that allows every future generation the option of being as well off as its predecessors.

The task of public policy under this perspective is to find a way to charge the economy for the consumption of its resource endowment and the environmental pollution. In order to do that, proper measurement of stocks and flows is necessary.

Based on this perspective, the main thrust of policy reform deals with correcting national economic accounts to reflect environmental amenities and consumption of non-renewable resources. For example, Solow (1992) proposes to treat environmental quality as a stock, a kind of capital that depreciates by the addition of pollutants and invested in by abatement activities. Similarly, rents derived from using up non-renewable resources should be kept and reinvested in building social capital. Solow (1991) believes that most environmental protection can be regarded as an act of investment.

The above framing of the question of sustainable development makes it possible to apply the logic of the economic theory of capital and use the same general principles as to other forms of capital. It also provides a practical step to sustainable development within the current institutional framework. If implemented, such an approach would make reproducible capital, renewable and nonrenewable resources, and environmental capital subject to the same scale of values and the same bookkeeping conventions. The main task for policy makers would be ensuring that the benefits from an expanding economy are reinvested.

Human Development School

Alternatively, the human development school of economics holds that sustainability is logically independent from economic growth. This school maintains that economic growth is only a means towards an end of a full human development (Anand and Sen 1994).

Proponents of human development school argue that human development should be based on principles of universalism. Human beings should have rights irrespective of class, gender, race, community, or generation (Anand and Sen 1994,

49). Universalism is defined as an elementary demand for impartiality - applied within generations and between them (Anand and Sen 1994, 4). The human development school then focuses on the capability of people and the freedom to lead lives that people today and in the future would value (Anand and Sen 1994, 17).

Anand and Sen (1994, 5) find that the integration of human progress and environmental conservation has emerged as one of the central challenges faced by the modern world. Because the moral value of sustaining of what we now have depends on the quality of what we have, sustainable development directs us as much towards the present as towards the future. Anand and Sen believe that the concept of human development can be broadened without any difficulty to accommodate claims of the future generations and the urgency of environmental protection. The basic underlying concept is universalism, they stress, and the key concept is justice.

The human development school distinguishes itself from standard macroeconomic analysis with its focus on wealth maximization at the aggregate level. The human development school is critical of this approach which focuses entirely on making the community as a whole as wealthy as possible, irrespective of distribution and irrespective of what that

wealth does to human life. Although human development school regards economic growth to be important, it does not take it to be in itself a sufficient basis of human development. The human development approach has tended to focus on public action and poverty reduction; it recognizes economic growth as a non-unique means for human development. There are other means of human development such as social organization.

The human development school views sustainability as a matter of distributional equity in a very broad sense. It treats it as a matter of sharing the capacity for well-being between present people and future people in an acceptable way, that is in a way which neither the present nor the future generations can readily reject (Anand and Sen 1994, p.31). They argue that human development should be seen as a major contribution to the achievement of sustainability. Thus the pursuit of human development becomes also a pursuit of sustainable development. This argument is contrasted with the position of the World Bank (1992) discussed below, which suggests poverty alleviation as an instrument to protect the environment from degradation.

As the macroeconomic approach above, human development school proposes using quantitative reporting to monitor progress to sustainable development. This reporting is pro-

vided by "human development index" which provides an alternative to the GNP per capita measure. However, the index is not exhaustive. It needs to be complemented by a detailed information on human development as provided in Human Development Reports.

Positive Linkages Approach

This approach is discussed amply in the Brundtland Commission's Report (WCED 1986) and in the *World Development Report 1992: Development and Environment* (World Bank 1992). The positive linkages approach to sustainable development emphasizes integration of environment and economic development as a common and mutually supportive objective (WCED 1986, ix). Environment is seen in a broad sense as a place where we live - bioregion, local community, or the globe. Development is what we do within that setting to improve our lives. Environment does not exist as a sphere separate from human actions, ambitions and needs. Development is not just what poor nations should do to become richer. The achievement of mutually supportive objectives must take account of the interrelationships between people, resources, environment, and development (WCED 1986, ix-xi). Sustainable devel-

opment is development that lasts (WB 1992, p.34). It is economic development that does not destroy environmental setting within which economic development takes place.

The *World Development Report 1992* explores the two-way relationship between development and the environment. First, it describes how environmental problems can and do undermine goals of development. The report identifies two ways in which this can happen:

- environmental quality is itself part of improvement in welfare that development attempts to bring. If the benefits from rising incomes are offset by the costs imposed on health and the quality of life by pollution, that cannot be called development;
- environmental damage can undermine future productivity. Soils that are degraded, aquifers that are depleted, and ecosystems that are destroyed in the name of raising incomes today can jeopardize the prospects for earning income tomorrow.

Thus damage to the environment has potential costs to present and future human welfare: human health may be harmed; economic productivity may be reduced; and the pleasure of satisfaction obtained from an unspoiled environment may be lost. For example, the Report quotes that water pollution and water scarcity lead to more than 2 million deaths and billions of illnesses a year attributable to pollution

and to poor household hygiene and added health risks caused by water scarcity. They also lead to declining fisheries, rural household time and municipal costs of providing safe water, aquifer depletion leading to irreversible compaction, and constraint on economic activity because of water shortages.

Secondly, the Report explores the impact of economic growth on the environment. The most important of these relates to poverty reduction - attacking poverty is essential prerequisite for environmental sustainability. The poor are both victims and agents of environmental damage. Poor families often lack the resources to avoid degrading their environment. About half of the world's poor live in rural areas that are environmentally fragile. Land-hungry farmers may resort to cultivating unsuitable areas - steeply sloped, erosion prone hillsides; semiarid land where soil degradation is rapid; and tropical forests where crop yields on cleared fields frequently drop sharply after a few years.

The Report stresses that the distinction between development and environment is a false dichotomy. Strong environmental policies also complement and reinforce development and vice versa. The Report also identifies the conditions under which policies for efficient income growth can comple-

ment those for environmental protection and identifies trade-offs. The authors of the report find that there are strong "win-win" opportunities that remain unexplored.

Often, policies that are justified on economic grounds alone can deliver substantial environmental benefits. The following are sample policies that improve both economic efficiency and the environment: eliminating subsidies for the use of fossil fuels and water, giving poor farmers property rights on the land they farm, making heavily polluting state-owned companies more competitive, and eliminating rules that reward with property rights those who clear forests.

Another World Bank publication, *Mainstreaming the Environment* (WB 1995, p.10) urges that "we go for the win-win options first." The authors point out that although trade-offs exist, there is often scope for improving the environment by adopting policies and investments that are justified for reasons other than the environment. These "free lunches", they caution, need to be exploited carefully.

Three patterns of relationships between rising economic activity and environmental problems are identified:

- some problems decline as income increases. This is

because increasing income provides the resources for public services such as sanitation and rural electricity. When individuals no longer have to worry about day-to-day survival, they can devote resources to profitable investments in conservation. These problems provide synergies between economic growth and environmental quality.

- Some problems initially worsen but then improve as incomes rise. Most forms of air and water pollution fit into this category, as do some types of deforestation and encroachment on natural habitats. Countries need to introduce deliberately policies to ensure that additional resources are devoted to dealing with environmental problems.
- Some environmental problems worsen as income increases. Emissions of carbon and of nitrogen oxides and municipal wastes are current examples. In these cases abatement is relatively expensive and the costs associated with the emissions and wastes are not yet perceived as high - often because they are borne by someone else.

Overall, two broad sets of policies are recommended by the *World Development Report 1992* that are in conformity with the findings of the *Brundtland Report*. These policies, that are both necessary, are needed to attack the underlying causes of environmental damage. First, we need policies that seek to harness the positive links between development and the environment by correcting or preventing policy failures, improving access to resources and technology, and promoting equitable income growth. Second, we need policies targeted at specific environmental problems: regulations and incen-

tives that are required to force the recognition of environmental values in decision making. On the analytical level, benefits and costs of all projects need to be formally valued, quantified and weighted against each other.

2.2.2. Perspectives on Organizational Change

Environment-development interaction may be seen as a problem of collective action and of problem solution emergence where processes of coordination and integration need to be achieved among environmental and economic institutional actors who also learn about direction of their efforts in action. Organizations, and organized systems are considered as, at the same time, the necessary means and the basic operational constraints of collective action (Crozier 1977). Social interaction is viewed as a process by which actors collectively solve problems (Mead 1934, Dewey 1938). Organization learning theories may provide insight into why strategies for economic development went wrong during the past four decades in Central and Eastern Europe and whether beneficial learning occurs during the present period of transi-

tion. The following research perspectives and approaches are the most relevant to the research problem of this thesis.

Organizational Adaptation

The organizational adaptation perspective views learning as an adaptive behavior. In its pure form, it is based on methodological behaviorism which emphasizes explanations for behavior in purely environmental terms. For example, Cyert and March (1963, p.123) state that organizations learn by exhibiting adaptive behavior over time. They focus on adaptation with respect to three different phases of the decision process: adaptation of goals, adaptation in attention rules, and adaptation in search rules. Cyert and March assume that organizations change their goals, shift their attention, and revise their procedures for search as a function of their experience.

Similarly, Vogeler (1987) defines adaptive learning as a change in organizational behavior in response to change in its environment in pursuit of a constant objective. Diverging from the purely behaviorist perspective, Fiol and Lyles (1985 in Tyre and Hippel 1993) define adaptive learning as both the investigation and subsequent changes in behaviors,

technologies, or beliefs undertaken in response to negative feedback. In this sense, adaptive learning has both a behavioral component (changes in performance) and a cognitive aspect (change in understanding).

A classical theory of organizational adaptation in an inter-organizational domain has been developed by Selznick (1984). Selznick studied the ideal of the grassroots in action in order to show how the ideal itself and the organization by which it was executed changed over time. He took a rather skeptical view of showing to radical idealists "the tyranny of means and the impotence of ends" - a process by which true organizational goals became deflected in action.

Selznick (1984, 4) proposed the following questions for his study:

- What is the organization which is thought to embody the ideal sought?
- What is the nature of its democratic technique?
- What are its implications and consequences?
- What will a close and critical study of the organization in action tell us about these problems?

For Selznick, the TVA is both an instrument of implementing the goal of the grassroots development and a living organization. In order to be effective in executing its task, the TVA has to adapt to its institutional environment whose power centers force the organization into self-defensive behavior. Policy and action of the TVA become caught up and shaped by the needs of the organization to adjust to its environment and by pressures exercised from intra- and inter-organizational coalitions of actors.

Selznick argues that the doctrine of the grassroots was logically self-defeating in its basic tenets:

- working through existing institutions;
- using voluntary associations;
- managerial autonomy.

While demands for managerial autonomy alienated the TVA from other federal agencies, the policy of working through existing institutions and using voluntary associations in the exercise of administrative duties opened the TVA to the co-optation by local interests. Co-optation as a defensive strategy is "a process of absorbing new elements into the

leadership or policy-determining structure of an organization as a means of averting threats to its stability and existence" (Selznick 1984, 13). The adaptive mode of action also led the TVA to use the official doctrine of "the grass-roots" as a protective ideology.

Selznick's main contribution seems to be in showing that an administrative agency's task to carry out predetermined purposes to achieve social change may be thwarted by its being also a living organism comprised of actors who develop their own independent objectives and commitments. This situation is exacerbated in the case of a grassroots method of administration by the need to adapt to the power interests in the institutional environment which may become counter-effective forces of change. A government agency in a hostile local environment adjusted to this situation through informal co-optation of opposition elements into its leadership structure, but this method of organizational adjustment gave rise to fundamental revisions in official policies and in organizational goal displacement.

In the end, Selznick (1984, 265) accepts the ambiguity of the situation as inevitable. Power in a community may not only result in the perversion of policy determined through administrative institutions, but provide a tool for ensuring

responsibility of public agencies to their client public. He does not see the existence of private organizations paralleling but independent of a governmental administrative structure, and exercising a decisive influence on social policy, as inherently bad.

Still, it appears that the main problem of the TVA's administration lies in its defensive relation to its environment. The TVA was a grassroots oriented organization seeking to adapt its behavior in response to changes in its environment as it pursued constant objectives. Rather than bringing in social change to a conservative region, it kept one step behind changes in its environment to which it strove to adapt.

Strategic Bargaining

Organizational action and learning are approached differently by Crozier (1977) who builds on Selznick's (1984, 12) notion of the TVA as a living social organization. Crozier distinguishes his dynamic framework from deterministic approaches which focus on organization's rationality, objectives, functions, or structures. In this respect, he differs from Selznick's concern with instrumental implementation of

organizational objectives. In Crozier's theory, organizations are structured systems of action. They are constituted of underlying "games" which mediate between the means and the ends of collective action. Balance among actors is maintained through the mechanism of bargaining.

Crozier believes that actors always possess some irreducible margin of discretionary freedom to choose among alternative options. He argues that actor's behavior should be analyzed "as the expression of a rational strategy whose aim is the use of power to increase his "winnings" through participation in the organization" (Crozier 1977, 45). Organization is studied "from the point of view of the relations of power by means of which the actors continually use the available zones of uncertainty to negotiate over the implementation of their respective strategies" (Crozier 1977, 44).

Crozier distinguishes four broad sources of organizational power (1977, 40):

- special skills and functional specialization;
- relations between an organization and its environment (gatekeeping);
- control of communication and information;

- existence of general organizational rules.

In all these instances, uncertainty is the basic source of power. Power is associated with social influence rather than with administrative hierarchy. For this reason, the superiors may not possess the power in the system of action to make their inferiors act on their orders. The actors maneuver to protect or increase their own margin of freedom of action while attempting to constrain the other's options. In pursuing their individual divergent and often contradictory strategies, the actors are being pulled by centrifugal tendencies away from collective action. They bargain with others to negotiate their participation and to make them "pay" for it.

For Crozier, learning happens within such a system of action. It is "the discovery, creation and acquisition by the actors concerned of new relational models, new modes of reasoning, and similar collective capacities" (Crozier 1977, 221). Also, learning is "a process of trial and error whereby a new behavior can be worked and developed into a system" (Crozier 1977, 223).

The existing power relations constrain possibility for learning and discovery within the system of action. For one,

threatening information will not be processed which, in turn, results in poor communication. Also, to be processed, problems have to be redefined either to fit prevailing games or to allow for the creation of some artificial uncertainties so that bargaining can proceed. The most serious problem associated with decision-making will be the impossibility of obtaining unbiased information.

Knowledge of the concrete system of action will make it possible to understand which decisions can be made in such a system, what are the limits on performance that can be anticipated and how the system itself can be changed. This sort of knowledge comes to actors through experience.

Experiential learning is important for actors also in order to understand what they have, often unaware, been seeking. Crozier (1977, 242) believes that people discover their desires in relation to the opportunities they perceive. Through acting in the social system and understanding their opportunities, the actors come to realize their own preferences. Thus learning has a dual consequence. It increases opportunity for actors to initiate change and it deepens their self-understanding of the kind of change they desire.

Like Selznick, Crozier accepts ambiguity and contingency as inevitable. He argues that we live in a world of conflict, power and manipulation (Crozier 1984, 248). Further, high organizational integration is undesirable because a tightly integrated society will have difficulty in changing and transforming itself (Crozier 1977, 226). Change is facilitated by the existence of slack and conflict in the social system.

Crozier's research framework provides many insights for the present research, particularly, his orientation to the inter-organizational domain as a system of action and the recognition of importance of active learning within this domain. But, it appears that Crozier's placing power relationships and strategic action in the center of his theoretical framework introduces a questionable bias and limits excessively the scale of possible interactions. In real life, actors interact in a domain characterized, in various degrees, by antagonism and cooperation (Schon and Rein 1994). Also, they often seem to set problems and invent solutions that evolve as a result of their transactions with the situation and with each other (Schon and Rein 1994, xix), rather than only calculate choices and bargain under the constraints of the system of action (Crozier) or adapt to the

external environment (Selznick). A framework of design conversation and organizational inquiry develops these alternative insights building on notions of "design rationality," "action frames," and shifting stages of interaction (Schon and Rein 1994).

Organizational Inquiry

These approaches to organizational learning build on the work of John Dewey (1938) who treated inquiry as the intertwining of thought and action that proceeds from doubt to the resolution of doubt. The action theory of Schon and Argyris (1996) provides an extension of this Dewey's insight. Schon and Argyris bring up in their book Dewey's thought that inquiry begins with an indeterminate, problematic situation, a situation whose inherent conflict, obscurity, or confusion blocks action (p.30-31). Inquiry, they say, combines mental reasoning and action.

The Deweyan inquiry finds further extension in two familiar organizational theory concepts. "Organizational dialectics" as an internal process of change through problem-setting, problem-solving, is a characteristic of an inquiry. The inquirers participate in constructing the situation to

which they also respond. As inquirers seek to resolve what is problematic about a situation of action, they bring new problematic features into being. The transaction between inquirer and situation is continuing and open-ended; the inquirer participates in constructing the situation to which he also responds.

"Detection of error," the second organizational concept, sets in motion the inquiry aimed at correcting the error. Schon and Argyris define the detection of error as the mismatch of outcomes to expectations. When outcomes of our action are mismatched to expectations, the inquirer experiences surprise - an experience essential to learning, to the process of coming to think and act in a new way. Thus learning is a beginning of an inquiry and may lead to other opportunities for learning. A "dialectics of learning" is a concept that needs yet to be examined.

In their recent book *Organizational Learning II*, Schon and Argyris (1996, p.10-11) define organization as a cooperative system governed by the constitutional principles of a polis. Following Chester Barnard (1938), they see organizations as systems of action in which individuals (or in my case institutional actors) cooperate to perform tasks. Schon and Argyris point out that the organization's task system, its

patterns of interconnected roles, is at once a division of labor and a design for the performance of work. Organization members' behavior is rule-governed; members of an organization enact rules for decision, delegation, and membership. They must:

- devise agreed-upon procedures for making decisions in the name of collectivity,
- delegate to individuals the authority to act for the collectivity, and
- set boundaries between the collectivity and the rest of the world (S&A 1996, p.8).

The definition of an organization as a task system might be extended to cover a situation of multiple institutional actors interacting around a project design.

Schon and Argyris define an improvement of an organization's task performance over time as a case of instrumental learning. Such instrumental learning rests on a schema which refers to an action's effectiveness in achieving its intended objectives and to criteria and measures for assessing that effectiveness (p.4). They point out that instrumen-

tal learning may be good or bad depending on the values used to define "improvement." They introduce a distinction between single and double-loop learning to differentiate instrumental learning within a constant frame of values from learning to change the values that define the "improvement." It appears that the double-loop learning may occur either due to intentional action or due to shifts in institutional environment.

The concept of inquiry shows also in Schon and Rein's *Frame Reflection: Toward the Resolution of Intractable Policy Controversies*. In this book, Schon and Rein (1994) contrast design rationality with instrumental, means-ends rationality. They summarize fundamental structure of design rationality in the following points (1994, 172- 3):

- There is always a process of making something out of materials, and under conditions of uncertainty and complexity.
- This means that intentions are always, to some degree, emergent. The designer must be able to form new intentions on the basis of her discovery of the evolving nature of the design situation in which she is engaged.
- The designer is always in conversation with the design situation. Design rationality is always, in part, a function of the conduct of that conversation, as the designer seeks to grasp the meaning of his moves, and of

others' responses to his moves, and to embody his interpretations in the invention of further moves.

- There is always a process of problem setting and solving, which can be evaluated in terms of its adequacy to the emerging intentions, values, and interests of the designer and other stakeholders in the design, and by reference to features of the design situation discovered through design inquiry.

Design rationality becomes of particular interest when it is located in a social system. Schon and Rein (1994, xviii) believe that when policy controversies (such as sustainable development) are situated in politically contentious arenas, they may lend themselves to pragmatic resolution through design rationality. They identified four types of pragmatic resolution: contention, marketing, negotiation, and codesign (Schon and Rein 1994, 124-5). However, Schon (1978) recognizes in his earlier work yet another mechanism for improving performance and resolving conflict - the organizations' ability to learn to learn. Thus both single and double loop learning should be associated with the design rationality and the study of a project design process within a politically contentious arena should provide access to understanding this learning.

I understand that the actors and their domain of action are embedded within a larger socio-economic and natural

environment which from a greater part may be considered non-deterministic particularly due to the dynamics of institutional change. The actors may influence this larger environment, but they cannot control it. They will face messy problematic situations which must be converted into manageable projects. It will be imperative for the actors to learn to listen to "back talk" of the situation and to understand conflicting conceptual frames in order to be able to correct for design flaws in the projects and avoid "stalemates," "pendulum swings" and "transaction effects" (Schon and Rein 1994). The projects will perform best if the actors learn to co-design them (Schon & Rein 1994) - the actors understand and anticipate meanings the users will attach to their design projects.

The concept of situational context within the theory of inquiry is well developed by Tom Burns who studies it from the perspective of social institutions. In his co-authored book *Man, Decisions, Society: The Theory of Actor-System Dynamics for Social Scientists*, Burns (Burns et.al. 1985) distinguishes his approach from rational choice and structural determinist theories. Burns argues among other, that the rational choice approach takes as given the factors and processes which structure options available for choice and

their outcomes (Burns et.al. 1985, p.9). The rational choice approach fails to recognize that preference structures, action alternatives and outcomes are structured and restructured as part of the historical development of societies. Thus social structuring, Burns argues, cannot be adequately specified and analyzed within the framework of rational choice theories.

The structural theories, on the other hand, lack concepts with which to describe and analyze human problem-solving, creative activities and conflict (Burns et.al. 1985, p.11). They do not allow for the idea that structure is being continuously opened up and reconstructed by the problem-solving behavior of individuals responding to concrete situations. Burns believes that we should investigate the human capabilities to overcome constraints by means of creative restructuring of their material, social, and cultural worlds.

Burns' actor-system theory provides a dynamic view of social interaction. The dynamics may be explained by a dialectical process in which human concepts and models of reality reshape the reality thus giving rise to new incongruences. Ultimately, ideas change themselves through process of action. People encounter problems, learn, and make discoveries. They come to realize new ideas and possi-

bilities, discover new material, social and cultural forms and elements. When these are put into practice or influence action, the stage is set for further learning, change, and development (Burns et.al. 1985, p.12).

2.3. Discussion

The macroeconomic approach can capture the problem of distribution of wealth between present and future generations and measure performance of economy on an aggregated level. It is based on a macroeconomic framework from which uniform policy prescriptions can be derived at the country level. The power of well formulated economic theory is to the advantage as long as the concept fits its boundaries that is as long as it can be conceptualized as a problem of economizing over scarce resources.

Since the resource allocation framework presents environment and economy as a "zero-sum" allocation game, it does not seem to provide room for creating value through social action as a creative destructive force (Schumpeter 1947) - innovating, restructuring, and transforming the conditions of life. The macroeconomic framework does not give advice on

the kinds of learning essential to sustainable development at the level of the region, sector, organization, or project. As Schon points out (Schon and Rodwin 1995, 92-93) the modeling/forecasting approach does not seem to provide an explicit account of the learning involved in a shift from present patterns of development to the patterns of sustainable development.

Also, even if the problem of development can be reduced to the problem of economy rather than seen as a problem of human self-realization and growth, the theory of sustainable development cannot be implicitly prescriptive with respect to organization of economy and society or human behavior over the long term. A distinction may be made between formal and substantive economics (Polanyi 1958). In the first sense, "economic" means to economize - to choose among alternatives for the purpose of maximizing output, profit, or gain in exchange or to minimize the cost of producing something in the face of material scarcity. The second sense relates to the arrangements and activity for acquiring, producing, or using material items or services for individual or community purposes. While the formal economics is not very useful for the study of planned economy or economies of

traditional societies, the substantive approach can be applied in a cross-institutional context.

Although the recognition in Anand and Sen's approach of the possibility to specify social ends on the basis of ethics and political deliberation is noteworthy, the principle of universalism seems to abstract from the wealth of institutional and cultural heritage social groups possess. It appears to avoid the difficulty of setting boundaries for the community that benefits from the welfare arrangements. Most importantly, universalism is non historical, disregarding the historical continuity of social groups and their change.

Even when ultimate ends may be specified theoretically on the basis of ethics, the chosen means and intermediate goals towards achieving the ends will not be universal and abstract. They will be specific - determined by present institutional arrangements, social customs and historical experiences. Burns (1985, 17) points out that different social positions and powers of actors lead to incompatibilities or conflicts not only in their goals and preference structures, but also in their viewpoints on action possibilities and decision strategies and their conceptions of appropriate arrangements for social action in particular

institutional areas and for the identification and resolution of conflicts in these areas. He states that conflicts manifest themselves in social patterns as a result of institutional specialization and the different roles actors and groups play in the organization of, and the decision and control processes in, society. Also, conflict patterns in society are shaped by differential socialization and membership in communities or groups adhering to different cultures and incompatible rule regimes.

Priorities in pursuing the ends will also be individual rather than universal. Social groups will want to choose which ends should be given relative priority given the circumstances and risks associated with pursuing certain courses. As Bell (1992) points out, we do not want to make the mistake of doing certain harm to present people in the name of future happiness that may never come.

Given the existence and desirability of differences among social groups in pursuing universally recognized ends, it is quite possible that chosen means and intermediate goals of different social groups will conflict. The conflicts, interaction among problems, and needs for organizational arrangements among various social groups pursuing their common goals, including goals of their own future generations, will

be intensified in an open liberal economy. They will also be exacerbated by geographical determinants such as population density, ecosystem resilience, availability of natural resources, size of territory, and climatic conditions. The theory of sustainable development will need to be able to address and analyze these differences.

The third approach seems closest to the purpose of my study because it approaches the problem of sustainable development at a project level allowing to see actor interaction. However, it does not recognize critically that any practical specification of goals or determination of costs and benefits is embedded in the social system. For example, goals may be specified with respect to societal functions, organizational outputs, investors, system, or product characteristics (Perrow 1968). Measurements of costs and benefits will be variable to economic regimes determining economic value such as specification of price as an expression of marginal utility in the market economy or as production costs in the planned economy. It will also be variable to legal regimes such as internalizing environmental externalities through legislative acts.

Also, this approach needs to recognize better that the problems of environment and development not only interact

with each other but also that their framing as a problem changes over time. Problems are not technical; they are constructed by human beings in their attempts to make sense of complex and troubling situations (Schon 1980, Lindblom 1990).

All of the three approaches above face the challenge of translating the outcome of sustainable development into operational criteria if it is treated at the level of policy analysis. Brooks (1992, p.32) argues that "for the concept of sustainability in the process of development to be operationally useful, it must be more than just an expression of social values or political preferences disguised in scientific language." He states that the usefulness of the sustainability concept depends on the degree to which it can be formulated in a relatively value-neutral way, susceptible to specifiable measurements.

Brooks (1992) summarizes some of these difficulties of operationalizing the concept of sustainable development to provide criteria for the choice of development strategies and for the selection and adoption of new technologies to support these strategies in a real world ecological, social, economic, political, and cultural context.

For example, Brooks points out that there is some ambiguity in what we define as "investment" and what we define as "current consumption" in the macroeconomic framework. Helping the poor today may be seen either as consumption or as investment in social capital to the extent that building sense of community will result in greater participation in society in future and hence increased capacity for coordinated action by the entire human community. We do not know how we decide with certainty whether this is investment or consumption (Brooks 1992, p.32).

In order to exercise rational choice, it is necessary to foresee sufficiently clearly where present trends and choices are leading and what alternative endpoints to those projected might be possible through the adoption and exploitation of new and emerging technologies or policy innovations. Thus rates of change in demography, social structure, and technology are important determinants of sustainability. But what may be sustainable in a slowly changing system may become unsustainable under conditions of more rapid change. Since the context is constantly changing, in part due to number of variables involved that are constantly changing on different time and space scales, no developmental scenario can be sustained indefinitely. Sustainability is an evolu-

tionary concept, confined to finite epochs in time (Brooks 1992, p.36).

Brooks (1992) concludes that the difficulties of operationalizing the concept of sustainable development are multiplied when the enormous number of possible social, economic, technical, and cultural variables are considered especially in the light of their complex interactions and interdependencies. This difficulty is exacerbated by the intrusion of a wide diversity of implicit or explicit and frequently conflicting value perspectives from both developed and developing worlds. Even when sustainability is acceptable in its general form, the existence of the diversity of value perspectives, derived from different life experiences and cultural histories, tends to undermine the possibility of any consensus in the most concrete decisions.

Even when Brooks is right in his observation on the difficulty of operationalizing the concept of sustainable development in technical terms, it is quite possible that some of the difficulties discussed by Brooks of studying sustainable development are rather due to formulating the research questions at the level of rational choice policy analysis. The structural difficulties of policy analysis approach to

studying policy problems have been noticed in the research community.

In *The Moon and the Ghetto*, Nelson (1977) discusses the limits of policy analysis. He asks the question of why we were so successful in sending astronauts to the Moon while we failed to solve the problem of the ghetto. He believes that this fact is due to the different nature of the problem to solve. Some problems are intractable, difficult to define and solve through the rational choice approach.

The normative structure of "rational analysis", Nelson states, rests on the logic-of-choice approach. But the logic of choice depends on prior specification of objectives, or agreement about the nature of relevant benefits and costs. The power of the logic also depends on the strength of the underlying scientific understanding of a problem that enables one to trace relationships between means and ends and to identify salient alternatives (Nelson 1977, p.24). The key elements of policy analysis are an agreement regarding objectives and strong scientific understanding of the topography of the problem.

The critics of the policy analysis raised a number of concerns about this approach. They pointed out that the higher-order value-determining processes tend to be ambiguous with

respect to precise criteria. Although market criteria used for valuation are relatively precise, government policy is for the most part not concerned with areas in which it is believed markets work well. Thus it is difficult to define benefits of particular classes of programs.

Further, the critics questioned whether analysts were not overstepping their legitimate role and interjecting their own values, or specifications of values that were analytically convenient into the policy-making process. They pointed out that policy analysts were biasing analysis of alternatives in dimensions that could be measured, and downplayed considerations that were difficult to quantify. Also, they claimed that the very process of policy analysis, in particular the attempt to make issues explicit and air them openly, was politically non-neutral (Nelson 1977, p.28).

However, the criticisms of policy analysis did not concern only the question of what is a good analysis and how to conduct a good analysis. They also brought up a more fundamental issue; there are many problems that are not adequately characterized as involving a "central steersman controlling a well-working rudder." Often, the chief problem of the central administration is to pick and choose a limited number of places and situations for strategic intervention, rather

than seriously trying to "steer the ship" in any detailed way (Nelson 1977, p.34).

Like any social ideal, such as "freedom" or "grassroots democracy," sustainable development has been an elusive concept that resists operationalization in technical terms. It is a dynamic concept whose meaning constantly evolves. It mobilizes people to act to search for its meaning in action. The answer to the problem of policy research on sustainable development may be to look not only at the level of policy analysis but also at the level of policy practice.

Rather than proceeding as the science foundationalists, beginning at a high level of abstraction and generality and looking for some apex value or some other key principle or concept from which to deduce a policy prescription, I will take the route of policy inquiry (Lindblom 1990). I will begin with relatively concrete questions and propositions asking: Who are the people for whom the relationship between environment and development is a problem? What is their situation? What do they think about it and why? What do others think about it and why? Can I find relatively concrete persuasive reasons for agreeing or disagreeing with either? On what grounds might my line of thought then in turn be challenged? (Lindblom 1990, p.42). To this set of questions I

wish to add yet another one: How do the actors learn in a problematic situation?

The problematic situation arises because the problems of environment and development interact as a result of a changing social context and actor learning, problem-solving and creative processes.

The above review of literature on organizational change suggests a number of questions to ask about learning in an inter-organizational domain of action. The most relevant to my research are the following:

- What action strategies were pursued by the actor system in order to achieve their task?
- What were the consequences of pursuing these strategies?
- What kinds of intervening conditions facilitated or constrained actional/interactional strategies?
- What were the specific properties of the modernization project problem?
- How were problems generated over the length of the project?
- When and how did organizational learning occur?

In my research, I will primarily follow the organizational inquiry framework. I will study organizational learning when actors inquire into the relationship between environment and economic development and design and implement projects under conditions of complexity, uncertainty, and institutional change that meet both the substantive requirements of problem-setting and -solving and the requirements, political and interpersonal, of sustaining the design coalition (Schon & Rein 1994, p.170). This framework is combined with inductive, action/interaction oriented analytical method of grounded theory (Strauss and Corbin 1990) and with institutional context framework of actor-system dynamics (Burns 1985). All of these perspectives on organizational inquiry share some common characteristics:

- the process of change is seen as non-linear,
- problems are not obvious but socially constructed,
- intentions get transformed through action, and
- consequences of actions may lead to new problematic situations.

The basic conceptual framework of my research is discussed in the next section on research approach and method and is illustrated by examples drawn from my cases.

Chapter 3

RESEARCH APPROACH AND METHOD

The above review of literature suggests that sustainable development can be approached as a process of social change and actors' inquiry into the relationship between environment and development. This relationship is perceived as problematic and stimulates actors to search for problem solutions. Thus the phenomenon of a modernization project design is analyzed as a process of organizational change and learning.

The literature review also suggests that an unfilled space exists to study the environment-development relationship from the practice perspective. Such a research will employ naturalistic, qualitative methods in contrast to positivist methods common in quantitative research. Employing qualitative methods might lead to new insights not available to rational choice policy analysts or to system level macro-economists.

The qualitative, naturalistic theoretical orientation may be characterized by the following (Lincoln and Guba, 1985, in Merriam, 1991, p.55):

natural settings, humans as primary data-gathering instruments, use of tacit knowledge, qualitative methods, purposive sampling, inductive data analysis, grounded theory, emergent design, negotiated outcomes, case-study reporting mode, idiographic interpretation, tentative application of findings, focus-determined boundaries, and special criteria for trustworthiness.

The three cases studied represent particular instances of such an inquiry. The project design is shaped in and emerges out of a field of interaction of the major social actors each inquiring into their own particular problematic situation. Separate actors leave and enter throughout the process and exercise greater or lesser control over shaping of the project design. The government inquires into the problem of shifting development path from extensive means of growth to intensive growth. The development bank inquires into the ways of stimulating economic growth in an environmentally sound way. The enterprise inquires into improving its performance according to performance criteria presented to it. The investors inquire into making profit. The center of the field of interaction focuses on attempts of the actors to resolve the inquiry through achieving efficient coupling of environmental quality and industrial production.

Data for this study was gathered from three projects in the Czech and Slovak Republics involving industrial modernization, foreign investment, and environment: an aluminum smelting modernization case, a paper pulp production modernization case, and a power plant modernization case. I researched background documentation on these projects in the European Bank for Reconstruction and Development and the World Bank, ran newspaper article search on electronic databases, and visited the sites. I was able to make over 60 interviews with managers and workers of the enterprises, government regulators, NGO's, development bank officials, community leaders, consultants and policy observers. I also gained substantial insights into the project development process through short term engagements as a consultant to the development banks.

The process of a project development throughout the period of political and economic transition provides a wealth of interactions and organizational processes to study the inquiry into the environment and development relationship. The modernizing industrial plants in Central and Eastern Europe were both heavily polluting and economically inefficient thus providing opportunity for projects that promoted both economic growth and improvements to the environment.

The selected projects represent complex significant experiments in environmentally beneficial modernization. They were selected out by purposeful sampling (Merriam 1991) from the group of industries dominated by large plants known to be responsible for a significant share of industrial pollution - energy supply, ferrous and non ferrous metallurgy, industrial chemicals, paper and pulp, cement, and mining. All of these projects were supported by a loan from a development bank (Appendix B). Building on efficient couplings was important in the transition process for both financially strapped enterprises and governments. The transiency of the situation highly increased complexity and uncertainty of the project development. Interaction among organizational actors was key to achieving efficient coupling in these projects.

3.1. Research Question

The problem of change, learning and need for the efficient coupling between environment and economic development are most dramatically raised in the context of the industrial modernization process in Central and Eastern Europe. The situation suggests the major problem of how organizations

can learn to manage better the industrial modernization projects so that they achieve efficient coupling. I believe that we can learn this by trying to understand the following general questions:

How do multiple organizational actors learn to design industrial modernization project in the context of interaction between environment and development and of institutional transition?

What is the nature of efficient coupling in the specific industrial modernization projects?

What types of productive organizational learning can I find within the model of development project organizational dialectic? How can we support this productive learning?

Can organizational change research derive policy recommendations in new useful ways?

3.2. The Transactional System

The conceptual framework provides focus for bounding the data collection and analyzing the interplay between the

actors' efforts to manage industrial restructuring and environmental improvements through investment and technological modernization and the policy dialectic which shapes these activities. The key concepts of the basic interactional framework - problem generating conditions, problem and its specific properties, problem solving strategies, consequences, and social context - are schematically described in Figure 3.1. The case specific conceptual framework of "learning efficient coupling" is shown in Figure 5.1 on page 170 and further developed in detail in Chapter 4. In order to make the framework more specific, I will describe it by the way of characterizing its key concepts and providing illustrations from my cases.

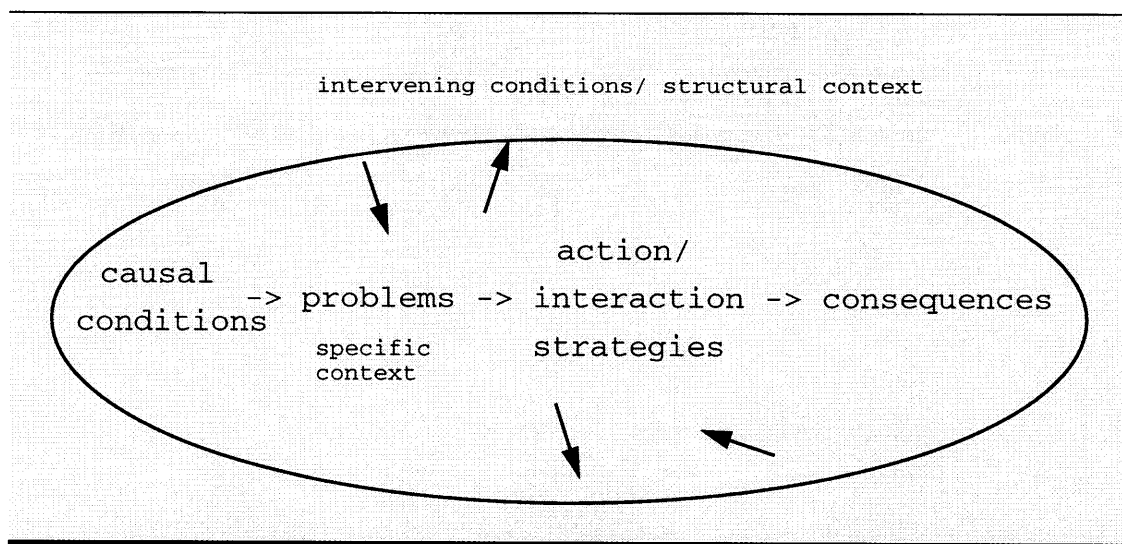


Figure 3.1: Basic Model of Interaction

3.2.1. Action/Interaction Strategies

Action/interaction is directed at managing, handling, carrying out, or responding to a problem as it exists in context or under a specific set of perceived conditions (Strauss and Corbin 1990, p.104). Action/interaction is processual, evolving in nature. It is purposeful, goal oriented, done for some reason - in response to or to manage a problem. However, failed or absent action/interactions are just as important to look for as when action/interaction is actually taken or occurs.

Some of the strategies found in the case data included bringing in investment, resolving technological design, green marketing, enterprise image building, enterprise restructuring, taking modernization loan, issuing stock to raise money, or even reforming the economy.

Industrial restructuring and modernization offer many strategies for improved environmental management: modernizing polluting technological processes and closing down the most obsolete ones; improving management practices on industrial sites; transferring technology, know-how and investment by attracting foreign partners; including environmental compliance and provisions in contracts; changing product

structure and improving product performance levels; remediating past pollution on industrial sites; improving environmental health and safety conditions; leap-frogging technological development; shifting to less material and energy intensive production; reducing waste streams; and installing pollution control equipment (Figure 3.2 on page 75).

3.2.2. Consequences

Action/interaction taken in response to, or to manage, a problem have certain outcomes or consequences. These might not always be predictable or what was intended. There may be consequences to people, places, or things. Consequences may be events or happenings, or they may take the form of responsive actions/interactions. They may be actual or potential, happen in the present or in the future. The consequences of one set of actions may become part of the conditions affecting the next set of action/interactions occurring in a sequence. Therefore, what are consequences of action/interaction at one point in time may become part of the conditions in another (Strauss and Corbin 1990, p.106).

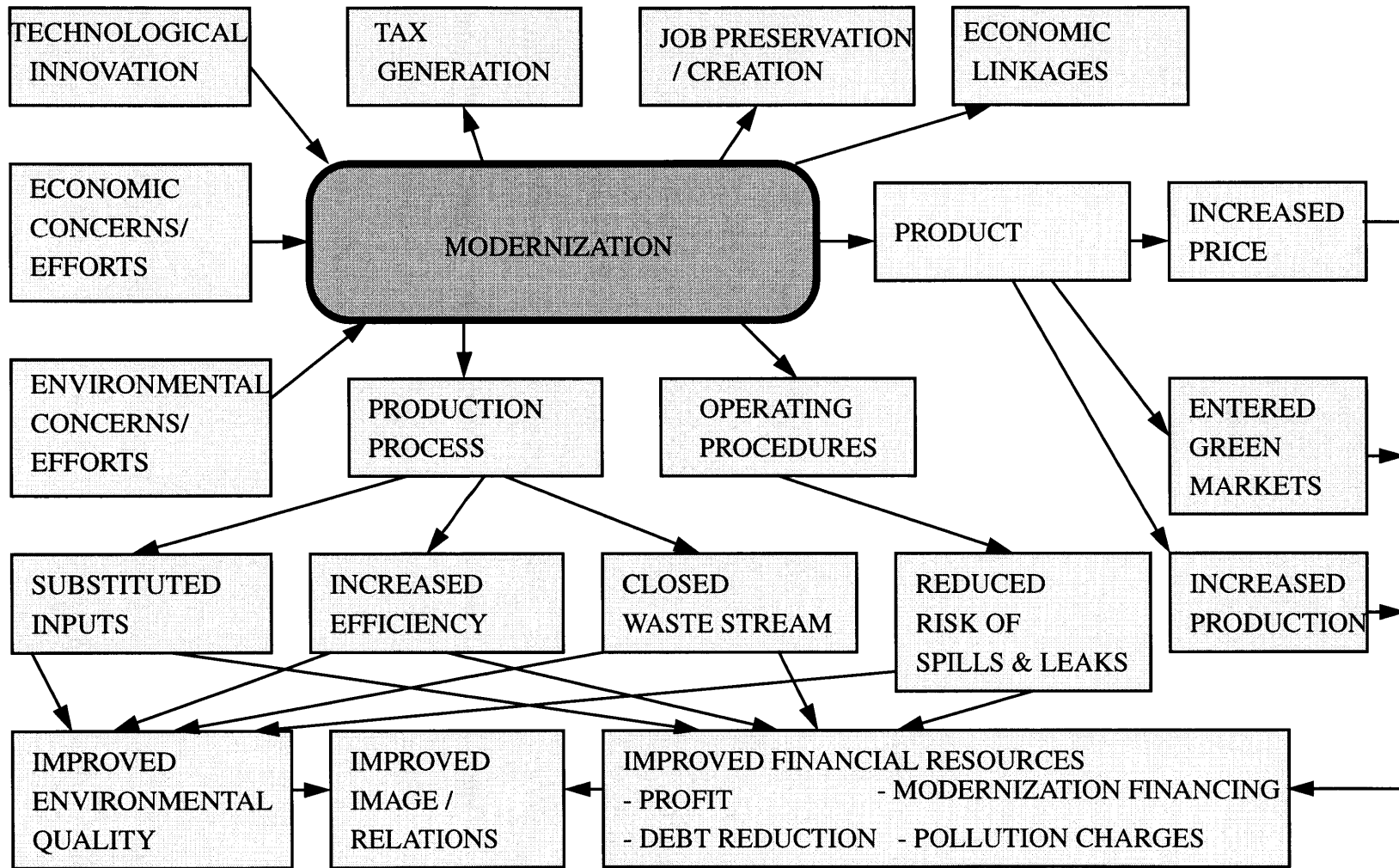


Figure 3.2: Generalized Action Map

A number of consequences can be found in the case data. For example, the enterprises restructure and privatize as a consequence of governments reforms. They discover underground pollution as a result of environmental appraisals requested for development bank loans. Also, they simultaneously improve their environmental performance and increase production as a result of the modernization project.

3.2.3. Problems

Problems or problematic situations are the phenomenon at the heart of my study. Following Dewey's insights, problematic situation is described as a situation whose inherent conflict, obscurity, or confusion blocks action (in Schon and Argyris 1996). Problems can be seen as the central idea, event, happening, about which a set of actions/interactions is directed at managing or handling, or to which the set is related (Strauss and Corbin 1990, p.100). The central problem of my research is the industrial modernization project design.

There are a number of mechanisms by which problems are generated and reshaped. For example, new problems become

visible as the others obstructing view are removed (clearing screen), new problems are created as the old ones are solved, actors' "push pull" creates problems for each other, or the specific or structural conditions change (Figure 3.1 on page 72).

3.2.4. Specific Context

A specific context represents the specific set of properties that pertain to a problem. It is also the particular set of conditions within which the action/interaction strategies are taken to manage, handle, carry out, and respond to specific problem (Strauss and Corbin 1990, p.101). For example, the problem of modernization project design has the property of high financial requirements, innovative technological design, increasing centrality of attention, and problem ownership by changing cast of actors from government, managers, development banks, to foreign investors (Table 3.1 on page 78).

The organizational actors have certain characteristics themselves. They have their own cognitive perceptions, value or preference structures, action strategies, social orienta-

Table 3.1: Properties of the Specific Context

technological complexity		
cast of actors	types	technology suppliers
		investors
		commercial banks
		government agencies
		NGO's
		enterprises
		development banks
	properties	cognitive perceptions
		value or preference structure
		action strategies
		social orientations
		knowledge
		performance capabilities
		objectives
		social orientations
environmental complexity	number of issues (single -- multiple)	
	significance (local -- regional)	
financial/economic complexity		
problem attention		
problem ownership		

tions, knowledge, and performance capabilities. The project problem-setting and problem-solving activities are shaped by

these actors as they acquire more or less influence over the project activities.

In my case, the following institutional actors are considered: government agencies, non governmental groups, enterprises, development banks, commercial banks, investors, and technology suppliers. These actors may have to learn over time to harmonize better their sometimes conflicting goals and achieve synergy in pursuing their aims as they each inquire into their problematic situations.

The foreign investors acquiring the privatized enterprises often seem to act under the profit making objective. However, there are a number of alternative reasons that lead foreign investors to the decision to invest abroad. For example, Aharoni (1966) describes the usual initiating forces behind foreign direct investment: drive of a high-ranking executive, outside proposals, fear of losing a market, the "band wagon" effect, strong competition from abroad, market for components and other products, utilization of old machinery, capitalization of know-how and spreading fixed costs, and indirect return to lost markets.

The investors developed their strategies for environmental issues. For example, they strive to avoid responsibility for the past contamination using management contracts, leasing

of properties and acquiring only assets, or building on greenfield sites.

The situation of development banks is more complex because they operate under multiple, conflicting objectives. In this respect, they resemble the situation of the state enterprise which also has to deal with the necessity of managing tension between public control and industry autonomy (Vernon 1985 in Vogeler 1987). The development banks operate under environmental procedures that condition funding of their projects on environmental soundness. However, being a dominant organizational actor, they show contingency reducing tendency - they tend to act on their environment so as to reduce its uncertainty and to shape it to requirements of their operations (Tendler 1975).

Both banks act under imperatives of "moving money" and "developing fundable projects" (Tendler 1975). Although they espouse the other objectives, their dominant measure of performance is expressed as an amount of money transferred into the region. The more money moved, the better performance. Staff members desiring career promotion are thus strongly motivated to focus on capitally intensive projects and on searching for new opportunities to invest money.

The governments of the transition countries act under the difficult imperative of restraining their expenditures at the time when domestic revenues are shrinking. In this situation, foreign investment provides an important opportunity of financial freedom to the otherwise hard-pressed government.

In contrast to banks, the NGO's seem to act under the imperative of raising operating funds from a voluntary membership. Their activities must appeal to a broad audience of supporters who contribute by paying membership fees. Their fundamentally activist orientation requires them to maintain the legitimacy of initiators of social change.

At the same time, the international "watch dogs" follow flows of foreign direct investment from banks and multinationals into countries of Central and Eastern Europe in an attempt to shape them to environmental purposes. Development banks in particular, from among the international financial institutions, are closely watched by the NGO's. These groups often believe that they have better chances of influencing environmental issues indirectly through operations of international financial institutions than directly influencing industry and governments of Central and East European coun-

tries. They make appeal to public accountability and transparency of decision-making.

Strategies of international NGO's differ according to position they occupy in the broad spectrum, from radical, direct action oriented to the more conservative, lobbying ones.

3.2.5. Social/ Structural Context

Social processes exhibit a high degree of context sensitivity (Burns et.al. 1985, p.237). A process may undergo adaptations or transformations as a result of changes in context. The changes in the context, on the other hand, can result from operations of the process itself or from exogenous influences outside of the actors domain of action.

This broader structural context pertaining to a phenomenon may be conceptualized as intervening conditions (Strauss and Corbin, 1990). Intervening conditions are the broad and general conditions bearing upon action/interaction strategies. These conditions include, among others, time, space, culture, economic status, social norms, regimes, and structures of roles.

Knowledge of specialized rules, rule systems relating to particular institutional settings and social organizations, is essential to effective participation in a society. Since the knowledge of specialized rule systems varies among the members of society, variation of this knowledge provides a source of strategic advantage and translates to different performance capabilities and effectiveness in social action. In practice, a rule system is almost never fully implemented. The actual, informal, rule system worked out in practice through persuasion, negotiation, conflict and the exercise of power among agents in the setting usually differs to a greater or lesser extent from the ideal, formal system. Any rule system in practice will contain "unwritten rules" which are known to those who practice the system. The informal rules may be unknown or invisible to those outside the system, uninitiated into the actual practices. The rule systems may be structured and change as a result of learning and innovation.

The social context is distinguished primarily by three types of rule systems - rule regimes, role structures, and process algorithms.

A rule regime is an institutionalized rule system shared by the members of a group, organization, society, or culture

(Burns et.al. 1985, p.263). A social institution is a rule regime which applies to a particular sphere of activity or class of settings and governs the social action and interaction of agents engaged in the sphere. A social organization is a specific instance of a social institution, a system of rules applied in a concrete setting.

Rule regimes are a source of expectation, a basis for actors to predict one another's behavior in the sphere of activity to which the regime applies. Rule regimes also regulate social action and interaction of the actors governed by the regime in the sphere to which it applies. Among other things, regimes specify who does what, when, how, and where. They identify different categories of actors and assign to them roles - actor specific rule systems.

The most relevant normative aspects of the social context in this research are shown in Table 3.2 below.

Throughout the periods of enterprise modernization processes studied, the organization of economic activity and structure of roles of state administration and industrial organization were repeatedly shaped and reshaped in the process of the government's inquiry into improving the country's economic performance. New conceptions of the problem of unsatisfactory economic performance were followed by

Table 3.2: Properties of the Structural Context

institutional regime - the social organization of economic activity and of environmental protection at the level of a country
different categories of actor role structures
typical process algorithms for a project design
interaction situation or game
social relationships
centrality of green
technological advance
external pressures
motivating forces

structural reforms that usually led to a new set of difficulties and a redefinition of the problem.

For example, the period of transition in Central and Eastern Europe has been determined by a large number of policy reforms. Along with macroeconomic stabilization and market liberalization, privatization has been seen as a chief strategy for achieving economic development and industrial restructuring. These reforms were intended to modernize and restructure industry and to reduce administrative controls over economic activity, particularly in areas where vested interests and rent-seeking opportunities were at stake (Kaufmann 1994).

Industrial restructuring commonly proceeded through privatization. It usually involved the steps of changing legal status from publicly owned enterprises to enterprises incorporated under private law (corporatization), commercialization and restructuring, and transfer of ownership to private sector (divestiture). This transfer was usually mediated by a holding company (state fund for privatization) and supervised by a Ministry for Privatization. The Ministry for the Environment may have been consulted on environmental issues depending on administrative procedures adopted by individual countries.

Restructuring strategies differed according to policy objectives emphasized by individual governments at various points of time. Countries may have stressed speed of privatization, restructuring before sale according to industrial policy, achieving high cash value to pay foreign debt, or to preserve and create employment.

The pre-transition period was characterized by radically different policies and institutions. All industry was state owned and fell under government control. Trade with the west was limited and enterprises had to conduct it through designated state monopoly trade organizations. Prices of inputs and outputs were administered and did not reflect the actual

market value of goods and services. Decision making was centralized and politically directed. Enterprise managers were mostly members of the ruling communist party loyal to the political system. Information was not exchanged easily and technological innovations difficult to learn about. Environmental quality information was also inaccessible and even if available, public voice to demand improvements was suppressed.

The post-transition stage is characterized by a shift of control from enterprise managers to investors, and stock owners. The enterprises have already been privatized and their stock is being freely exchanged. Basic economic institutions of market economy such as taxation law, bankruptcy law, and securities laws are in place. Foreign investors are free to purchase companies and restructure them to their liking. Government largely withdrew from productive economic activity which is left to the private sector. Capital is easier to obtain and the role of development banks is diminishing while the role of foreign investment banks increases. Domestic banks also become able to provide loans for a longer term and on a lower interest. Commercial risk of the transition is being seen lower. Basic environmental laws have gen-

erally been written so that expectations for environmental quality are more clear.

The international project financing through the development banks faces many constraints. For example, loan can often be issued only with sovereign guarantee of the recipient government to cover the country credit risk. The government must allocate for a specified amount of funds in its state budget to provide this guarantee thus straining its already limited balance of payment capacity. This situation is complicated by currency exchange risks. While the loans are issued in foreign currency, project revenues are mostly in a local currency. Thus the ability to repay the loan may change dramatically with shifts in currency exchange rates. Also, the international banks are constrained by prohibitively high transaction costs that allow them to lend money only to the large projects exceeding minimum of about \$5 million. Next, direct borrowing from the international development banks can only cover a part of the investment costs, usually about 30-60% of the total cost. Lastly, the standard repayment terms that the banks are providing do not always match the debt service capacities of the projects. Short grace periods and loan maturities may lead to financing gaps

while too long periods expose the projects to additional currency and interest rate risks.

3.2.6. Dialectic Process of Change

The actor interaction over time is viewed as a process of change. Actors set problems and invent solutions that evolve as a result of their transactions with the situation and with each other (Schon & Rein 1994, xix). Process can be seen as the linking of sequences of action/interaction as they pertain to the management of, control over, or response to, a problem (Strauss and Corbin 1990, p.143).

The linking of sequences in a process can be accomplished by noting:

- the change in conditions influencing action/interaction over time;
- the action/interactional response to that change;
- the consequences that result from that action/interactional response;
- describing how those consequences become part of the conditions influencing the next action/interactional sequence.

Table 3.3: Critical Learning Processes

type	problem solving	reframing
		effective task performance
	skill acquisition	
	associative learning	classical conditioning
		instrumental conditioning
	observation learning	imitation
	navigation into a new situation	
	sensitization	
	habituation	
	chaining/sequencing	
	concept formation	
	benchmarking	
	aikido	
	double loop learning	
	forgetting	
	insightful learning	
	role performance	
	exploration	
frequency	high -- low	
productivity	high -- low	

Change can be the consequence of planned action/interaction or it may occur as a result of contingency, an unanticipated and unplanned for happening that brings about change in conditions. Process explains why action/interactional

routines break down, why problems occur in the course of life events, and why when looking back at life one sees growth, development, and movement (Strauss and Corbin 1990, p.144). The process of change can be seen as learning when we can identify performance that improves over time. Also, learning activity must be new to the actor, begin and end with more than one event, and be transferable from one kind of situation to another (Schon 1994, p.40). The critical learning processes found in these cases are shown in Table 3.3 on page 90.

3.3. The Concept of Efficient Coupling

The concept of efficient coupling is descriptive of what were the desired project outcomes in my cases. It is useful to other people as they try to think about how to create conditions at the local level for successful project outcomes.

The concept of coupling has a long history of usage in literature and in technical discourse. In its broad sense, coupling means joining in couples, pairing, or linking, for example the pairing of the sexes in the sexual union (Oxford

English Dictionary). The word *coupling* also refers to anything that couples, or is used to join together.

The word coupling has many technical and scientific uses¹. In mechanical engineering, it is the name of various contrivances for connecting parts of constructions or machinery, especially in order to transmit motion. For example, it describes the contrivance for connecting the ends of shafting together, either permanently, or so as to admit of their being disconnected when needed. It also refers to the chain or link connecting two carriages or trucks of a railway train. Next, it describes carriage-building such as the connexion or joint upon which the fore-carriage turns or locks, or the attachment of whatever kind uniting the hind to the fore wheels. When speaking of organ, coupling means the contrivance for connecting two manuals, or a manual with the pedals, or two keys an octave apart on the same keyboard, so that both can be played by a single motion (Oxford English Dictionary).

In genetics, *coupling* usually refers to the situation in which two dominant factors were contributed by the same par-

1. For example, we find electromagnetic coupling, magnetoelastic coupling, bending-torsion stiffness coupling, cross-coupling, mode coupling, mutual coupling, reactor coupling, wave coupling, strong coupling, weak coupling, computer coupling, direct coupling, dynamic coupling, functional coupling, non-linear coupling, reductive coupling, thermodynamic coupling, and vibronic coupling.

ent. In physics, *coupling* is used to describe a connection between two oscillating systems which results in a mutual dependence of their oscillations, so that oscillation in one system causes an oscillation in the other and partly determines its character. Such a connection may be either physical or inductive. The strength of this interdependence is being characterized as tight or loose coupling and is measured by the coupling coefficient. If a considerable portion of the field of force of the first circuit is embraced by the second, the coupling is fast (tight); if only a small portion, the coupling is loose. The looser the coupling between the two circuits, the less rapidly is the energy of the oscillating circuit used up and the more persistent is the oscillation.

In atomic, nuclear, and particle physics, *coupling* is used to describe physical interaction between two particles, between a particle and a field, or between two fields; specifically, it refers to an interaction between the magnetic moments of the electrons in an atom. It is also used of the combination of mathematical quantities (in quantum mechanics) which corresponds to the physical interactions. The strength of the type of interaction between a particle and a field or between particles is measured by a coupling con-

stant, for example, the strong interaction between mesons and nucleons, and the weak interaction between four fermions. This is analogous to the electric charge, which is the coupling constant between charged particles and electromagnetic radiation. Maximum coupling is 1 and no coupling is 0.

Electrical engineering also makes extensive use of the word *coupling*. Two or more electric circuits so arranged that energy can transfer electrically or magnetically from one to another are called coupled circuits. Coupling is again described as close or loose. A close coupled process has elements with small phase shift between specified variables; close coupled systems have large mutual effect shown mathematically by cross-product in the system matrix.

Computer systems that share equipment and can exchange information are also called coupled systems. The manner and degree of interdependence between software modules is classified into standard types that include common-environment coupling, content coupling, control coupling, data coupling, hybrid coupling and pathological coupling (IEEE standard 610.12-1990). Common-environment coupling is a type of coupling in which two software modules access a common data area. Content coupling is a type of coupling in which some or all of the contents of one software module are included in

the contents of another module. Control coupling is a type of coupling in which one software module communicates information to another module for the explicit purpose of influencing the later module's execution. Data coupling is a type of coupling in which output from one software module serves as input to another module. Hybrid coupling is a type of coupling in which different subsets of the range of values that a data item can assume are used for different and unrelated purposes in different software module. Pathological coupling is a type of coupling in which one software module affects or depends upon the internal implementation of another.

In all these various uses of the concept *coupling*, the main idea seems to be that of an interaction between different properties of a system, or an interaction between two or more systems. The extent of this interaction is expressed by the coupling constant or coefficient. **The coupling coefficient determines the coupling efficiency.** A highly efficient, close coupling exhibits high mutual effect that can be measured as a cross-product in the system matrix. However, it also simultaneously shows high instability and low persistence.

The properties of coupling relevant to the project outcomes of the researched cases are shown in Table 3.4 on

page 96. The coupling is said to have members consisting of

Table 3.4: Properties of Efficient Coupling

members of coupling	environmental improvement	type (eliminated substances from use; improved product quality; closed release of emissions/effluents; remediation of historic damage; occupational health/safety;)
	company profitability	type (reduced operating costs; reduced capital costs; increased product price; increased sale/ production volume; improved organizational performance;
	regional economy	jobs
		taxes
		linkages
manner of coupling	monopolistic coupling	
	market coupling	
	managed coupling	
persistence	high -- low	
degree of interdependence	tight, loose (strong, weak)	coupling coefficient (determines the coupling efficiency)
technological advance	high -- low	

enviromental improvements, economic benefits and benefits to regional economy. These memebbers are coupled in a specific

manner as either monopolistic coupling, market coupling, or managed coupling. The coupling has a certain degree of persistence, and interdependence. It also has the property of technological advance which is valued by the actors who are motivated by technological prestige.

In choosing the word *efficient coupling* as a descriptive concept to characterize desirable project outcomes pursued by the actors in my cases, I omitted other descriptive and normative concepts frequently encountered in discussion on sustainable development. The concepts such as *one solution for two problems*, *synergies*, *linkages*, *joint benefits*, *integration of goals*, although similar in meaning, do not capture what seems to me to be important about project outcomes in my cases.

When closely analyzed, the above concepts of the sustainable development discourse differ in critical aspects from the descriptive concept I selected for this study. *One solution for two problems* does not say much about the characteristic of the solution other than that it somewhat economizes on energies spent in pursuing it. *Integration of goals* again does not say much about the characteristic of the outcome, but rather prescribes the process of going about it.

Synergies understood as *increased effectiveness, or achievement produced as a result of combined action or co-operation* (Oxford English Dictionary) or a *product-market posture with a combined performance that is greater than the sum of its parts* (Ansoff 1965, p.75) implies the process by which the increased effectiveness is to be attained. *Efficient coupling* while also meaning the *increased effectiveness, or achievement*, remains neutral with respect to a mechanism by which the outcome is achieved. Since the mechanism is a subject of inquiry, *efficient coupling* appears to serve better my purpose.

Linkages, on the other hand, hints at a key property of the solution - its interdependent nature. However, it seems more general in its meaning than *efficient coupling* whose strength lies in its formal usage in scientific and engineering literature with associated specific properties. *Joint benefits*, commonly used in literature on negotiation, appear to miss the key property of interdependence which makes the description of outcomes so difficult to grasp.

One of the key feature of the outcome of efficient coupling is that it occurs through a collapse of two interacting values of the coupling. When the coupling becomes efficient, the relationship between the two values of economy and envi-

ronment is self-referential. As it will be amply shown in the cases, the analyst is being left confused about what is environmental benefit and what is economic benefit when they constantly influence each other. The puzzlement about what is external to the situation is typical for the efficient coupling whose mutual effect is calculated as a system cross-product rather than as aggregation of individual values typical for economic determination of cost-benefits.

Efficient coupling as a concept is more specific than the "diabolic" concept of *sustainable development*. However, I hope that if used normatively, the concept of *efficient coupling* might serve as a "practical step toward sustainable development." For example, the concept of *efficient coupling* could be used as a criterion to guide to *sustainable development* at the project level.

In the following sections, the outcomes of efficient coupling and the process of problem-setting, problem-solving and pursuing efficient coupling are illustrated on three case studies of industrial modernization combined with environmental improvements and foreign investment. The first case describes a process of aluminum production modernization which brings couplings among technological modernization, increased product volume, decreased consumption of

inputs, tax base generation and past pollution remediation, improving workers health and safety conditions, reducing air pollution and increasing energy efficiency. The second case of paper pulp production modernization is a case of eliminating a toxic chemical from a production process while simultaneously closing the waste stream. This is achieved with an increase of production capacity and an expansion of a new product to an environmentally aware market. The last case details a large scale program of air pollution cleanup conducted by a monopoly power company. Although this project utilizes end-of-pipe pollution control technology, benefits are still achieved through an increased social legitimacy which is necessary for utility rates increases.

Chapter 4

LEARNING EFFICIENT COUPLING IN ENTERPRISE MODERNIZATION PROJECTS

The following sections present detailed case study analytical interpretations of the industrial modernization projects - aluminum plant modernization, pulp and paper plant modernization, and power plant modernization. They discuss first the conditions of interaction which gave rise to actors' learning in the situation and led to emergence of efficient couplings. Next, they analyze the richness of learning experiences which shaped the project designs throughout the process. Last, they analyze the specific nature of the efficient couplings that were achieved in individual cases.

4.1. Power Plant Modernization

4.1.1. Conditions of Interaction in Power Plant Modernization

The complex program of the CEZ to modernize its power plants in order to reduce their environmental impact

resulted from a sequence of earlier actions. In particular, it was an attempt for dealing with heritage of centralized planning in the energy sector.

Initially, the Czechoslovak government's inquiry into furthering economic development was based on orientation towards heavy industry. The strategy of boosting up economic growth as fast as possible and of building heavy industry called for energy supply to feed the economy. Decision was made to construct a large number of coal fired thermal power plants concentrated largely on a brink of open pit coal mines in Northern Bohemia.

At that time, the autonomy of the CEZ to make any decision was curbed by its role as a state owned monopoly producer of energy in the country. The CEZ simply executed decisions of its superiors in the Ministry of Industry and Energy. At first, environmental impacts of coal mining and coal burning in power plants did not matter in the government's strategy of achieving economic growth. But as the sky darkened and forests in Northern Bohemia started dying, impacts of power plants operation on human health and environmental quality became apparent. Hard data was difficult to obtain, but every citizen of the country knew about critical environmental situation in Northern Bohemia.

The government's strategy for rapid economic growth supported by cheap and abundant energy put the CEZ into the position of the worst polluter in the country. In spite of the fact that the power plants burned the low calorific, high sulphur content coal, they were fitted with no desulphurization equipment until recently.

Although action alternatives were known to technicians in the CEZ who followed technological developments in neighboring countries in the west and often participated in international scientific conferences, their knowledge could not be put to much use due to the institutional regime of the country. The CEZ managers had no access to material resources to construct the scrubbers and any request for significant amount of investment funds had to be approved by the supervising government agency. Thus access to action resources was severally constrained in the structure of role relationships in which the CEZ was causing the pollution but could not prevent it.

The structure of economic roles within the COMECON system also required that when the decision to develop a technology to curb sulphur dioxide emissions was finally made, a Soviet design scrubber was adopted as a problem solution. This decision had little technical merit but brought the Czecho-

slovak government into conformity with norm expectations of not seeking the technology in the West.

Consequently, the CEZ underwent a traumatic experience of building the new Soviet design scrubber based on a technology that was never tested in operation before. After the embarrassing experience of wasting lots of money, good will, and technological credit, the CEZ resolved to never again experiment with untested Soviet technology.

At that time, the Czechoslovak government's inquiry into economic performance brought about the dramatic transition of the 1990's. The CEZ was facing a new situation. When the state administered trade was abolished, the CEZ could suddenly acquire the technology from the west. Following the price reforms, prices of most goods were determined by the market even though energy prices were still set administratively. Privatization and restructuring also affected the CEZ significantly because the company was substantially downsized when various parts of it were spun off as individual units.

The economic transition was also accompanied with political democratization which brought public pressure on the company for its environmental record. Soon, the CEZ came under concentrated fire of all possible domestic and inter-

national environmental groups as the number one polluter in the country.

During this initial period of economic and political transition, the CEZ was in a hostile situation taking one blow after another. As a result, when the new strict air pollution law was passed, the CEZ did not contest it. Instead, it did what it was good at. It drafted a comprehensive program of power plant modernization that would clean up its pollution. It anticipated that its effort for compliance with the new air pollution law would bring it into favor of the Czechoslovak Finance Ministry and would improve its public image.

The struggle of the CEZ to comply with the new law and fix its image of the polluter brought problematic situation for the Czechoslovak government. After all, the CEZ was still a majority government owned utility. It was necessary to support the CEZ in its struggle with correcting past neglect particularly when environmental benefits of the CEZ's modernization program were so high. Thus the Government's strategy to help out the embattled utility was decided on. The CEZ received a sovereign guarantee for a World Bank loan - the only such a guarantee ever given by the Czechoslovak government for a project based World Bank loan.

Although the World Bank loan made it possible for the CEZ to start up on its power plants modernization project, the CEZ still had to find the right technological solution. Because its past experiment with the Soviet scrubber which employed regenerative technology did not work out, the CEZ rejected not only the Soviet designed technology but also any experimenting with untested but possibly ecologically sounder desulphurization technologies.

The problem of finding the right technological solution for power plant desulphurization became a case of a situation when state of technology did not permit action possibilities. The CEZ had opportunity to make long term investments in environmental control technology. The new strict environmental law prescribed it to take action else its power plants were shut. In its position of a state controlled utility, it could possibly find investment funds for the modernization. But the state of the art in desulphurization technology proved constraining. The conventional fluid gas desulphurization technology commercially available in the market used high amounts of lime or limestone in its operation while leaving substantive amounts of solid waste as a residual of desulphurization.

Thus the CEZ's acquiring the conventional fluid gas desulphurization technology created a number of problems for its operations. The CEZ had to find a sufficient supply of lime to feed the scrubbers in operation. It had to deal with criticism from environmental advocates who charged it with freezing unsatisfactory technology for a long time and with shifting pollution from one type of media, air, to another type of media, solid waste.

The problem of choosing technology for power plant modernization was perceived differently by the workers and managers of the concerned power plants. They seemed to believe that in the situation of job uncertainty and organizational restructuring, sinking a large modernization investment in a power plant would provide security to power plant operators that their plant would not be closed down in a near future. Since operating time for a scrubber is about fifteen years, some of the scrubbers will outlast the power plants to which they were attached.

The problematic situation of power plant modernization looked differently to the technology suppliers. They saw a unique action opportunity to sell technology which was developed and operated conventionally abroad. They knew they

could supply the scrubbers by a turn-key method with simultaneous provision of investment loan.

An alternative strategy to installing the end of pipe pollution control equipment could have been in switching production inputs, in this case imported black coal for domestic brown coal. Burning higher quality coal would have somewhat reduced emissions from smoke stacks. However, this option was constrained by the Czechoslovak Government's predilection with improving economic performance and managing economic and political transition of the country.

Although the institutional regime of the Czech Republic opened to free market economy and international trade, the energy sector was too sensitive both economically and politically to be left to market forces alone. Downsizing mining activity or closing mines completely was seen by the government as a potentially politically dangerous move that had to be prevented by government policy. The CEZ found that though the economic regime had changed to the extent that coal could be purchased in free market domestically, rather than allocated administratively, foreign imports were restricted by government policy. In particular, purchases of high quality Polish coal, which could have been burned in these power plants, were limited by import quotas.

A new need for dealing with action constraint arose from vertical demonopolization of energy production of the country. The structure of roles in energy generation and energy distribution changed so that one company, the CEZ, produced electricity, and other companies, regional distribution enterprises, were responsible for connecting and selling energy to households. The CEZ had now to negotiate prices of energy with the distribution enterprises which could effectively bargain over price in their independent position. Also, the amount of electricity sold by the CEZ depended on ability of the distribution enterprises to connect households to electricity grid and servicing them effectively. The CEZ was constrained on the demand side.

The regional energy distribution enterprises were put into position of independence by the government decision to separate out energy distribution from energy generation. They soon started buying electricity not only from the CEZ, but also from other smaller suppliers domestically or from foreign energy utilities abroad. The creation of competition in energy supply strengthened bargaining position of the regional distribution enterprises in bargaining electricity prices.

The efforts for restructuring the organization of energy production and consumption in country also triggered internal disintegrative forces. These forces were exacerbated by provisions of the privatization law which gave right to independent candidates to submit privatization proposals. As a consequence, the CEZ had to deal with power plants submitting their own privatization proposals and asking for organizational autonomy from the CEZ. The fears from past redistributive practices which allocated funds arbitrarily and under political influence were overcome only with difficulty.

The CEZ overcame the problem by devising a strategy of raising money collectively for modernization of all the power plants. This could be achieved more effectively in common than by each power plant on its own. The argument for collective action seemed to work by contrasting it with the Polish experience where power plants gained independence, but found it hard to get financial credit for their modernization.

The power plant operators were also comforted that scarce financial resource would not be allocated to completion of the nuclear power plant in Temelin which would put them out of job when started up. They realized that electricity

demand would not drop significantly and that their power generating capacity would still be needed. The power plant operators resolved to change their social orientation and to cooperate with the CEZ in producing electricity as one organization. They found that decentralization and autonomy had their own limitation and that they could achieve better results through organized action. They also experienced that when cooperation was voluntary rather than imposed and coerced, they could live with it.

Even when the CEZ won the internal battle for integration and organizational reorganization, it still had to face angry public. Its ravaged public image needed correction. Particularly citizens of Northern Bohemia had to be persuaded to trust the CEZ that it will clean up pollution from its energy plants. Their impatience with the situation after they gained political freedom in 1990 was potentially dangerous to the CEZ.

The CEZ established office of public relations and developed public information programs that would provide better information to the public. The citizens gained confidence they could speak to representatives of the CEZ about their situation and that their voice would be heard without going on occupational strike. The CEZ found that the public would

gain trust in their desulphurization efforts as soon as construction of the first scrubbers was contracted out.

Although the CEZ obtained the World Bank loan to start up its plant modernization program, the total financial requirements of the program by far exceeded the amount of the loan. The CEZ had to find alternative ways of raising large sums of money from commercial markets in order to finance the modernization. It knew that the World Bank loan had improved its credit worthiness, but that it still had to do better to obtain the necessary funds.

In order to raise the necessary funds at acceptable interest, the CEZ had to improve its business image. It invited an internationally recognized financial auditing firm to publicly testify that its accounts were in order and that information presented in its annual report was correct. It further invited Standard and Poor's rating agency to award it investment credit. These steps helped the CEZ increase transparency of its financial practices and obtain a high ranking BBB- investment grade credit that improved its business image.

Encouraged by its success, the CEZ also invited the Japanese JBRI to scrutinize its financial condition. When it received the A- credit rating from the Japanese, it discov-

ered that Japanese banks consider them a low credit risk because they treat majority government ownership similar to state sovereign guarantee on loans. It realized that it was a desirable business partner for Japanese banks.

Following the first success stories, the CEZ pursued further steps in its financial strategy. It discovered that funding the power plant modernization program would be cheaper through raising general credit rather than through seeking project specific loans. Building on this knowledge, it issued successfully three emissions of bonds on domestic capital market and the emission of Eurobonds.

The domestic banks that were approached by the CEZ to provide the funding for the modernization program found out from the credit ratings and annual reports that the CEZ was a good business partner to whom they could trust their money. In a situation of widespread defaults on loans by the industry, they were convinced that the CEZ could be lent the money. The foreign banks also observed that the CEZ was a reliable and desirable business partner when J.P. Morgan Securities issued its Eurobonds. They were impressed that the CEZ was the first East European industrial enterprise that successfully introduced its bonds on European capital market.

Consequent to its successful steps in financial strategy, the CEZ had become the most sophisticated issuer in the domestic financial market. It set a benchmark with its long term bond issue in the domestic market and played the role usually taken by the government. But it also realized that it reached limits of the domestic financial market which was not large enough to satisfy its credit needs. Even when the CEZ would be exposed to foreign exchange risks, it had to reach out and borrow internationally.

In the meantime, the international financial institutions faced stiff competition from each other in the syndicated loans market. They had to reduce their interest on loans in order to conduct business. The CEZ becoming aware of this situation, changed its strategy and borrowed further funds from commercial banks eager for business rather than issuing more Eurobonds. It discovered that it could gain a significant reward for this strategy when it arranged a multi currency revolving loan with Summitomo bank. By obtaining this loan, the CEZ set another benchmark. When other industrial enterprises heard that the loan was granted on such an unusually low interest rate of 25 points above LIBOR, they required the same low interest from their financial institutions.

4.1.2. Organizational Learning in Power Plant Modernization

The power plants modernization case begins with the Czechoslovak government's learning to direct energy future of the country in a centralized way. The government engages in problem solving activity to set policies and establish institutions that would meet the long term energy demands of the country. This inquiry is part of the government's orientation towards heavy industry which requires reliable energy supply. As part of the long term strategy for the energy and economic future of the country, the decision is made to build the power plants and to orient the country towards energy generation from coal.

Consequently, the CEZ and its predecessors engage in learning to play the role of an energy utility within the centralized system of economic management. Although action alternatives are known to the utility technicians who travel abroad to international conferences and exchange information, their organizational role constrains them to a limited course of action. Their assigned role within the larger whole of the COMECON ultimately determines their choice of technology for the first experimental scrubber. Financing of the investment is provided as a matter of course by the state. The role the utility and its staff learn to play is

that of a subordinate in the hierarchically organized state administration.

However, soon after the power plants are constructed, the citizens of Northern Bohemia, the CEZ staff, and the government officials learn that energy generation in coal-fired power plants is associated with serious environmental damage. They learn through this conditioning to expect that energy generation from coal will be associated with environmental costs in the future. Further, the CEZ is conditioned into its subordinate role expecting that its decisions will have to comply with the government's political line and that a proposal for Soviet technology, whatever its quality, will be easier to pass through.

However, after the CEZ fails in its attempt to bring the Soviet designed scrubber into operating condition, its staff learns through instrumental conditioning to associate Soviet technology, or any experimentation with technological design of a scrubber, with a punishment of a certain disaster. They overlearn and become conditioned to avoid any such an action in the future again.

When the political and economic transition of the 1990's comes, the CEZ starts learning to navigate in a new situation. The CEZ typifies the new situation to the old by

designing a comprehensive program of long term investments in environmental protection. The CEZ staff is good in the practice of long term comprehensive planning so that approaching the problem in a comprehensive way is a familiar task to them.

Further, the CEZ passes through a process of sensitization when public pressure against its actions increases. With public discontent threatening its coal power plants in Northern Bohemia and its nuclear power plant in Temelin, Southern Bohemia, the utility becomes highly sensitized to public perception of its actions. As a response, the CEZ learns gradually to improve its skill in public relations and dealing with the public. A special department of public relations is established and proactive educational programs are launched.

All of the domestic actors, the NGO's, the government, and the utility, learn extensively through imitation. The NGO's create alliances with the greens in Austria and Germany to conduct joint protest actions. They learn to organize in the way their western counterparts do, and design adversarial pressure strategies in a similar manner.

Imitation plays a key role in restructuring of the energy sector of the Czech Republic and privatizing the utility.

Models of energy sector organization are searched for extensively abroad and discussions are conducted about merits of each particular model. In the end, centralized energy generation is temporarily accepted while the demand side is broken up to create competition.

The learning to navigate into a new situation also involves habituation of the past conditioned responses. The need for habituation is the most clearly visible in the centrifugal tendencies unleashed by the organizational restructuring of the utility. In the past period of centralized planning, the organizational units of the CEZ learned to associate collective action with the practice of redistribution of resources in the center based on political favoritism. Because they expect a similar association in the future, they demand their organizational autonomy from the CEZ. Only slowly do they habituate this response and become content with their organizational inclusion in the CEZ.

All the while, the utility is engaged in benchmarking against other utilities. When it comes to choosing the technology for its power plants modernization program, the CEZ has already learned what its counterparts in the world are using and what conventionally produced technology is available for them to buy. Since they benchmark themselves

against the industry while at the same time remain risk averse, they select to buy the best available conventional technology on the market. In the discussion about merits of buying a cheaper, second order technology from the west, they clearly opt for getting the best available. The technological advance rather than cost seems to be the main decision criterion.

Most interestingly, the utility learns to apply aikido, using the action energy in the direction it is going, in its problem solving strategies. Its aikido strategy is best apparent in the way the CEZ handles the new strict air pollution law. While most of the industry complains about its strictness and looks for ways to avoid compliance, the CEZ embraces it foolhardily. Although compliance with the law will be very expensive, the CEZ can use this to its own advantage. It uses the momentum of action to borrow as much money as possible as fast as it can. While the government is happy that its law is being implemented, the CEZ being a state owned monopoly does not have to worry about the cost of modernization. It will be passed on to consumers who demanded the law in the first place.

The aikido strategy was learned and applied already sooner even though not in such a clear fashion. During the discus-

sions on internal organization of the CEZ, the proponents of decentralization pointed out possible dysfunctions of collective action as they experienced them in the past. However, the CEZ management was able to turn the large size of its organization to its advantage by drawing on its pool of resources to obtain favorable credit rating. Only through the feared collective action was the CEZ able to raise sufficient funds for the large scale modernization.

The major problem encountered by the CEZ in relation to the power plant modernization project certainly concerned its financial strategy. By a process of trial and error the CEZ step by step proceeded in improving its credit rating image and finding new successful strategies of borrowing money. When its strategy of issuing domestic bonds was successful, the CEZ did not stop there by repeating only this success. Instead, it explored further to expand into the Eurobond market. When issuing Eurobonds was again successful, the CEZ found even better deal in the syndicated loan market.

In each particular step of the process, the CEZ was rewarded by a success, but it kept going. It was learning to finance its modernization in a better way rather than sticking to a strategy that proved successful before. This

approach can be seen as deuterio loop learning, or learning to learn, rather than as an instrumental single loop improvements in performance. By this learning process, the CEZ became a benchmark for the industry rather than benchmarking itself against the others.

4.1.3. Efficient Coupling in Power Plant Modernization

The main coupling in this case arises between electricity rates and reduced air emissions and may be called *monopoly coupling*.

The highest environmental improvements of the coupling derive from reducing release of emissions of sulphur dioxide. No substance is eliminated from production process, on the contrary, limestone is added in the scrubbing of emissions. No remediation of historical damage is associated with this coupling and product quality - electricity generated - remains the same. No direct effect on occupational health and safety is apparent.

Profitability of the company will be improved particularly through an anticipated increase of product price. Compliance with the air pollution law should make it possible for the

CEZ to legitimize an increase of its energy rates so that a return on investment in pollution control technology is gained. Operating costs of energy generation somewhat increase by adding pollution control technology although some of the cost will be recovered by selling the side product of gypsum cardboard. Although capital costs of the clean up program are immense, their relative expense declines through learning processes employed in raising the funds. It also declines due to the cross-border impact of the environmental improvements which motivate neighboring countries to "bribe" the CEZ into compliance by offering financial grants.

Production volume from the coal burning power plants somewhat declines due to plant closures. However, product volume is higher than required by the Czech economy because some of the electricity is exported abroad. These exports of product to a green market (switzerland) are tied to diverting profits of the transaction towards achieving environmental compliance of the power plants.

Restructuring is relatively unaffected by the air emissions control program.

Returns to regional economy come from reduced damage to forests and buildings from acid rain and from improved human

health. They are also derived from maintaining employment in the power plants and contracting construction companies to build the scrubbers.

The coupling in this case is attached from environment to economy. Environmental improvements and compliance with the air pollution law provide energy for increased company profits in the future. This is possible because the coupling occurs in a monopolistic organizational environment where political legitimation of the investment is more important than market prices. Time dimension of the coupling is long term. Profits are expected in the future when energy prices are adjusted to financial flows of the CEZ.

4.2. Pulp and Paper Plant Modernization

4.2.1. Conditions of Interaction in Pulp and Paper Plant Modernization

The SEPAP's story began when the Czechoslovak Government decided to expand production of pulp and paper in Steti. At that time, planning of the expansion was fully under control of the central planners. The government of Czechoslovakia provided money, technical assistance and supplied construc-

tion materials and technology. The needs of the construction project were planned for in the plan that designated suppliers and construction companies to do the work. For the Czechoslovak Government, the expansion of the SEPAP provided a solution to its need to boost up quickly production and provide employment for a large population in the region.

For the wider regional population and the town of Steti, the construction of a factory with many stable job opportunities satisfied their desire to find employment. The large factory in the town provided the community with the means for earning their livelihood. They welcomed the construction and applied for jobs to work in the factory. The goal for the new factory to expand and produce quickly was shared by all the involved actors - workers, government, and enterprise managers.

When environmental situation in the Czech Republic started to deteriorate, the Government and the SEPAP managers were brought to face impact of the production of pulp and paper on natural environment. The government passed new environmental laws as a strategy of dealing with the situation. This action created a new problematic situation for the SEPAP's management who now had to respond to government's effort for regulation. However, the management could negotiate their

compliance with the state regulators and in many instances was able to secure exceptions for effluent discharges. They found that their production was more important than its impacts on the natural environment.

Still, water pollution persisted given the performance criteria specified in the law on clean water. Thus the managers resolved to draft a plan for modernization of the SEPAP that would satisfy the government's desire for increased production and at the same time, include in the plan a provision for construction of a water treatment plant. Their strategy of presenting the government with an investment expansion plan that would include both production and environmental investments worked out. Together with a new Kamyr boiler, the plant got a new water treatment plant.

At the same time, the SEPAP installed a regeneration boiler that would burn lignin extracted from wood chips during pulping process and a new bleaching plant. As a consequence, use of chlorinated substances in production process increased. However, the lignin removed during the bleaching operation could not be regenerated in the recovery boiler nor treated in a waste water treatment plant. Thus this step of modernization combined with first measures for environmental protection caused redefinition of the problematic

situation. The main environmental problem no longer was organic matter released into water but rather the presence of chlorine in the waste stream that prevented treatment and regeneration of the waste effluent. Elemental chlorine and sodium hypochlorite became the main problematic substances in the production process.

As the SEPAP got to be known as one of the largest dischargers of AOX and COD to the Elbe River, the situation with respect to SEPAP's environmental performance weighted them. The social context shifted at this time. The enterprise gained more freedom to retain profits and decide on its investment needs. The government in its inquiry into improving chronically declining economic performance gave the enterprise substantial freedoms compare with the past. The structure of the role between the government and the enterprise changed. The enterprise was supposed to exercise financial self-management while the government was supposed to change its activity from direct control and assigning plan targets to indirect controls through financial incentives.

Thus the shift in the structure of roles between the government and the enterprise and the growing awareness of environmental degradation led to a redefinition of the prob-

lematic situation. The responsibility for pollution and for initiative to improve the situation was shifted towards the enterprise.

The enterprise managers accepted the challenge. They designed a long term strategy of a step by step modernization of their production process that would, in the end, eliminate chlorine from their operations. At the same time, they again used the action opportunity for combining environmental improvements with increasing production capacity.

Social orientation of the managers also contributed to the forming of their action response. Because most of the managers grew up in the local community, they considered themselves responsible to their fellow citizens. The risk of potential chlorine leak during transportation and handling seeped into awareness of all citizens of Steti including that of the managers. The managers' awareness of threat of potential chlorine leak to the local community contributed to their desire to eliminate chlorine from their operation. The community realized that the managers cared about the threat, but that they could not immediately eliminate it. The community and the enterprise settled on a compromise solution of trading jobs for potential threat to human health.

The SEPAP's managers, who found themselves in the problematic situation that called for modernization of production in SEPAP again, devised a long term strategic plan of action.

The strategy they developed, the step by step gradual replacement of component parts of the production process that would ultimately result in elimination of chlorine created a new need for implementing the plan. The SEPAP managers had to negotiate with technology suppliers in a situation when their bargaining power was significantly constrained by the economic regime of the country which did not allow the enterprise to engage in a trade with the west directly. The regime of the state administered trade and the structure of roles in economic organization of the country required SEPAP to arrange trade through designated state trading companies that had access to foreign currency and license to interact with the west.

The SEPAP's modernization project also created business for domestic banks which were approached to help finance the production expansion. The banks devised a strategy of financing that would enable the SEPAP to acquire the technological equipment through long term leases guaranteed by the domestic bank. Even later, when the economic regime changed and trade with the west was opened up, the domestic banks

provided the service of selling credit guarantees to enterprises borrowing money from foreign commercial banks. The domestic banks found that even when their limited resources and financial instability of the country did not allow them to lend money on a long term credit with a low enough interest, they could still get business by selling the loan guarantees.

The domestic banks' service of providing loan guarantees and arranging leases to enterprises matched with the SEPAP's strategy of going about implementation of their modernization efforts within the institutional constraints of that period of time through arranging for the leases. However, the SEPAP made the experience that its limited bargaining power often resulted in the technology supplier's bargaining up prices and crossing out pieces of technology from the "shopping list" supplied by the SEPAP.

In the meantime, the Czechoslovak government struggled with its problem of improving economic performance of the country. It feared that any decrease in standard of living could lead to popular unrest and loss of power by the communist party.

The Soviet reform movement provided a window of opportunity for the Czechoslovak Government to follow the lead. It

devised a strategy of economic reform modeled on Gorbachev's Soviet reforms of "perestroika." The Czechoslovak government's strategy of economic reform followed the Soviet principles of moving to full financial self-management of enterprises and to pursuit of industrial democracy through creation of worker's councils. However, the Czechoslovak Government's reform proposal came late.

The long term problematic situation of declining economic performance and suppression of political freedoms was resolved by popular discontent culminating in political and economic reforms of 1989. The public realized that it had the power to effect change if it exercised voice. It also became aware that this time, the Soviet Union would not intervene in the Czechoslovak domestic affairs.

The radical change of 1989 started a transition to establishing new economic order, adopting new social institutions, and changing the cast of the actors and their internal organization. For one, the Czechoslovak Government dramatically reorganized its internal structure. Old industrial ministries were dissolved and other were created particularly at the level of the Republics. In particular, Environmental Ministries were created to lead government efforts and design strategies for improving environmental quality.

The creation of the Ministries of Environment was followed by tightening of environmental regulations and writing new environmental laws that limited actions of enterprises with respect to using environment as a sink for pollution.

The economic transformation brought about a fundamental change in the structure of enterprise and government roles. These roles were specified in the new laws on private enterprise and on transformation of state property to private property. It also brought creation of markets on both supply and demand side.

The strategy of economic transformation adopted by the Czechoslovak Government restructured the problematic situation faced by SEPAP. Supplies of materials and demand for pulp and paper were no longer coordinated by the state planners, but instead regulated by the market. The SEPAP management had to find customers for its products, reorganize and privatize the enterprise and function in the new institutional regime and structure of roles.

While SEPAP was restructuring its internal operations, privatizing the company and functioning in its independent role of a private enterprise, its modernization project faced financial crisis. The government's strategy for improving efficiency of economy and for its reorientation to

environmentally sounder light manufacturing and consumer product industries resulted in withdrawing financial support to private enterprises. No more environmental investment grants were available to industry. Further, bankruptcy law was passed freeing exit for firms that were not performing well. When a party newspaper customer disappeared after the newsprint paper machine was reconstructed at a great expense, the company faced a serious financial crisis.

In responding to the company crisis, the management had to take notice of the new actors who entered the situation. The most relevant new actors on their horizon were western commercial banks, development banks, strategic industry investors, and privatization investment funds. The entrance of these actors into the situation provided a whole new set of action opportunities for the enterprise managers.

While dealing with the internal reorganization, the SEPAP management had to take into consideration the change in enterprise control. The managers invited the new company owners to a quasi-share holder meeting as soon as the situation permitted. In this way, they made sure that their plans for enterprise development would not be blocked later by the new company owners.

However, even when the SEPAP management designed and consistently pursued its modernization plan, it could not avoid dealing with surprises that distracted them from their course of action. When the community of Steti gained its political voice, it learned that it could use the Environmental Inspection Office to further their environmental priorities. With the assistance of the Inspection, they forced on the SEPAP managers action on cleaning odorous substances that was not planned for and did not fit into the orderly course of events. Instead of pursuing their step by step process of technological modernization and machinery replacement, they had to retrofit the old machinery with pipes to capture odorous substances. Retrofitting the old technology rather than bringing in a new one was seen as a lesson in bad planning by the enterprise management.

To deal with the financial crisis, the management freed the SEPAP of the burden of the newsprint production and the associated financial obligations by creating a subsidiary ROTO a.s. ROTO a.s. was formed as a joint venture with Leykam Murztaler. By separating ROTO a.s. out as a separate enterprise, the attention of managers could be focused fully on SEPAP. Also, SEPAP's annual reports cleaned up to actually show profits so that image of the company improved.

A major other step in building up the image and performance of the company came with securing the modernization loan from the European Bank for Reconstruction and Development. In arranging the loan, the EBRD played its role of a lead financing and risk reducing institution. When the EBRD was willing to provide the loan, the other commercial financial institutions were willing to syndicate it.

However, in the process of obtaining the loan, the SEPAP's modernization problem changed again. The SEPAP no longer dealt with environmental problem defined as elimination of chlorine from its production process. The EBRD's loan procedures required the SEPAP to undertake environmental and energy audit that brought up environmental problems that were not part of the modernization plan. Thus, the management became aware of the significance of a potential ground water and soil contamination in closing loan transactions. The significance of potential environmental liabilities to investors was underestimated before.

The EBRD in its role of a catalyst of private funding and a leader setting customary business practices in the transaction situation also helped attract a long term strategic investor. The EBRD's provision of a loan signalled to the industry that SEPAP's business plans were sound, that eco-

conomic, financial, and environmental appraisals were completed to the satisfaction of the Bank and that the company was a desirable investment opportunity and a reliable business partner.

Finding out about the EBRD-SEPAP deal, the Swedish conglomerate AssiDoman became aware that it was all right to invest in SEPAP. It quickly signed an agreement with the SEPAP on long term technological cooperation and gradual increase of investment in the company. The first investment decision was made just a few days before the deal between the SEPAP and the EBRD was closed. The SEPAP found that its image projecting strategy worked and that its efforts to project image of an upbeat profit making company could attract financial and business investors.

However, the SEPAP also discovered that too much of a good image might attract undesirable attention. Swedish AssiDoman was not the only industry investor who was impressed by the SEPAP's image of profitable company. Other investors heard about it and stepped in.

When the Stratton Investment acquired a controlling block of shares in the SEPAP, both SEPAP's managers and Swedish investors were caught by surprise. The SEPAP's management realized that they no longer exercised the same control over

the future of the company as before and that the shareholders of the company could prepare them surprises obstructing their carefully designed long term company development plans. Now that the government withdrew from direct supervision and control, the company owners were a factor exercising decisive influence on their business plans. They found that too much publicity and attraction might not be good for the company and its managers. They became aware that the image of profitable, environmentally green company could work for them as much as against them.

4.2.2. Organizational Learning in Pulp and Paper Plant Modernization

As in the other cases, the pulp and paper story begins with the government's problem solving effort to start up production as fast as possible while at the same time achieving its other goal of providing regional job opportunities. The large centralized plant simplifies administrative provision of social services - housing, health care, and recreation. Consequently, the regional population passes through the first stage of conditioning to learn to associate the plant with economic well being of the region.

As industrial production in the plant continues and expands, impacts of environmental pollution on surrounding natural environment become apparent. At first, they are ignored in the light of the economic benefits achieved and the one sided orientation to economic growth. But slowly, environmental pollution gets correlated with industrial production in the region and all the actors initially involved - the government, the workers, the community, and the enterprise management learn to expect this association.

However, during this first period of time, the actors learn to respond by doing nothing about the pollution. This strategy is rewarded by approval from the institutions of government and industry administration and from the members of the communist party monitoring activities in the plant. The instrumentally conditioned strategy of doing nothing remains in use even after the association of environmental pollution with industrial production is learned.

Finally, when the first steps towards correction are taken, the problem solving activity is conducted through employment of aikido strategy. The enterprise managers utilize the energy going in the direction of economic development to devise a solution that proposes further expansion and modernization of production while at the same time also

includes some environmental investments. The shopping list for modernization includes both items for expanding production and purely environmental investments such as a water treatment plant and a regeneration boiler. Once going through the administrative approval process, the energy required for passing items in one or both of the categories is close to the same.

However, the modernization problem is reframed after the initial problem solving steps are taken. As the water treatment plant and regeneration boiler are installed, attention is cleared for seeing other problems. Also, the existence of the regeneration boiler, which is the first link in the chain towards closing waste emitting processes, focuses attention on the new priority problem - chlorine. When the waste treatment plant and the regeneration boiler reduce releases of organic matter, chlorine becomes much more visible as a problem. It not only becomes more visible because the old problem of organic waste is reduced, but also because the new pieces of technology are not capable of treating chlorinated waste.

While the first technological modernization proceeds, the structural context shifts so that the enterprise learn a new structural role in the centralized system of management.

Through practice, it improves its role performance of financially self-managed enterprise taking partially its own decisions.

Since the aikido strategy in the first round of modernization is rewarded with a success, the project proponents learn to repeat the same strategy again. During the second stage of modernization, a new aikido strategy is formed. This strategy again combines production increases with environmental improvements.

However, this time the modernization strategy requires a significant amount of learning to chain the steps of technological improvement in the right order. Step by step, the production process is overhauled to reduce and finally eliminate chlorine while at the same time increasing production capacity. Key pieces of technology are acquired over a long period of time in such a fashion that production may continue while the improvements take progressively place.

During this period of enterprise operation in the centralized planning system, the community and the plant management learn to live in a mutual accommodation. The community is aware that the enterprise brings them jobs and that they need to live with its dangers. The plant managers on the other hand are part of the community. Most of them rose though the

ranks and worked in the plant since their teens. The mutual accommodation is rewarded by a peace in the town and expectations grow that nobody will challenge the status quo.

From the beginning, the project promoters are learning through trial and error to finance the project. They discover that they could arrange acquisition of western technology through leases guaranteed by domestic banks. This arrangement works best in the institutional environment of centralized economic management. However, the same arrangement is being used even after the political change while the domestic banks are not yet able to provide long term credit and their financial resources are limited.

The problem solving of financing through trial and error resumes by exploring alternative sources of financing from the EBRD and strategic investors after leasing is no longer necessary. At that time, the institutional transition leads to reframing of the problematic situation faced by the SEPAP's management. Supplies of paper and demand for pulp is no longer coordinated by the state planners. In order to justify the production expansion and elimination of chlorine from production process, profit based reasons have to be supplied and market for the new chlorine free product has to be found. While modernization justification and methods of

acquiring and financing the needed pieces of technology change, the overall structure of the modernization plan remains intact.

The modernization problem is also reframed by the entry of new actors who exercise influence on the problem definition. The most significant redefinition comes about with EBRD's financing. The required environmental appraisals of the SEPAP plant show environmental problems that were either considered low priority or were not known at all. Since perspective of the development bank on needed environmental improvements differs from that of the enterprise managers, problem definition and priorities change.

However, the most dramatic interference with problem definition by a new actor arises when the local community complains to the Environmental Inspection. The Inspection by its order to clean up immediately odorous substances escaping from the plant disrupts the long term plans of the project designers. As a consequence, the plant managers are forced to install an end of pipe technology on production processes that they already plan to phase out thorough the technological modernization.

The institutional transition leads to concept formation learning. New concepts of marketing and financial management

are introduced and learned. Also, concepts of new actors entering the scene such as development banks, international environmental groups, and foreign investors are formed and learned in the process of interaction.

Close to the concept formation learning comes imitation learning. Concepts and action strategies are not only formed anew, but also imitated from those observed abroad. The most striking imitation learning is seen in SEPAP's striving for public image building. Annual reports on glossy paper are published and freely distributed. Established accounting firm is invited to inspect and verify accounts. Financial results of the firm are proudly reported in all major newspapers of the country to catch public attention. At the entrance to the plant, the old worker's militia guard armed with a gun is replaced by a young attractive women receptionists.

The investors learn to associate EBRD financing with thorough appraisal process and with sound business plans for the companies. They form expectations that EBRD financed projects are sound and desirable investment. Thus the EBRD loan with the SEPAP brings a heightened interest from foreign investors.

In the end, the SEPAP learns that attracting too much interest may not be in the best interest of the managers of a company which is relatively small by industry standards. Their image building drive suffers instrumental conditioning punishment when their long term plans with Swedish industrial partner are so suddenly interrupted by the surprise acquisition from Stratton.

4.2.3. Efficient Coupling in Pulp and Paper Plant Modernization

The efficient coupling in the pulp and paper plant case can be characterized as market coupling - entering new green market while simultaneously eliminating chlorine from both the product and the production process.

Environmental improvements come most significantly from eliminating chlorine from production process with the consequent closing release of chlorinated effluents into the river. Product quality is also improved with elimination of elementary chlorine from the product with future possibility of introducing totally chlorine free paper. Occupational and regional safety increases with reduced transportation and handling of liquified chlorine.

Regional impact of the environmental improvement is cross-boundary since the River Elbe to which the SEPAP releases its emissions flows through the neighboring Germany. Some remediation of historical damage follows as a consequence of EBRD's environmental appraisal which identified problems with solid waste disposal and soil/ground water contamination.

Company profitability is improved through associated strategic business plan which is based on perceiving and exploiting new opportunities that have opened up after the economic transition. Product price should increase when ECF and TCF pulp and paper is sold in foreign west European markets. Production volume will also increase when the company successfully enters their targeted markets which require chlorine free paper. Restructuring of the company is somewhat facilitated in that the project supported by the loan from the EBRD gives the company a good image which attracts strategic investors. Capital costs increase to cover price of introducing the new technology. However, due to the timing of the capital expansion during the period of industry downturn, capital expenses on purchases of new technology are lower than during the upturn. Operating cost somewhat decline because the new technology is more efficient so that

lesser amount of production inputs is required and present and future emission charges on the release of pollutants decline.

The coupling is pursued in a highly competitive organizational environment. Market regulation and price setting provide the most important task focus for the project proponents. During the final stages of the SEPAP modernization project, no financial grants or government support are available.

Regional economy returns are derived from preservation of employment opportunities, generation of taxes, and creating upstream business for domestic forest industry.

The coupling is attached in the direction from economy to the environment. Energy for the project is supplied by the perceived business opportunities that require satisfying environmentally aware German market. the improvement of the production process follows from the improvement of product quality. No compliance with environmental laws is immediately required although future laws restricting emissions of chlorinated substances are anticipated.

The coupling is achieved on an almost immediate time dimension; the elimination of chlorine and expansion to new markets are simultaneous in time.

4.3. Aluminum Plant Modernization

4.3.1. Conditions of Interaction in Aluminum Plant Modernization

The establishment of ZSNP as a producer of aluminum in Ziar was a result of the Slovak and Czechoslovak governments policy of economic development. The governments faced the problematic situation of regional underdevelopment in Central Slovakia and of the necessity to function as a production base within the larger economic system of COMECON. The adopted strategy provided a solution to their problematic situation as it was perceived at that time.

While during the cold war the company's primary role in the centralized production system was to supply aluminum to the defense industries, the company was later assigned a new role of a civilian supplier when the embargo from the west was lifted and the cold war tension somewhat declined.

As new production facilities were built over time, the ZSNP expanded into new areas of operation. After it started producing alumina in 1956, high and low pressure casting, and finally manufacturing of the semifinished products were added. In developing these organizational capabilities, the ZSNP drew on traditional craft skills of local people who built a tradition in metallurgical activity in the region.

Shortly after the start of production, the ZSNP and the community of Ziar noticed undesirable impacts of aluminum production on environmental quality around the plant and on worker's health in the plant. The management's task gradually changed to include concern not only for increasing production but also for the growing adverse impact of this production on surrounding natural environment and on workers health. At the same time, the role of the community changed from serving as a host to the plant which provided jobs, housing, recreation after work, and regional economic growth to that of receiving both positive gains from the plant and adverse impacts of production.

The government officials and central planners also heard about the adverse impacts of production on workers health and surrounding environment when reports came in and the ZSNP management started drafting plans for adding on pollution control equipment.

The central planners and the company management had to implement the environmental protection measures through the system of centralized planning and investment. As a first strategy adopted to deal with the problematic situation, primary emission control equipment was installed in the

smelter to reduce amount of air pollution generated by the plant.

At the same time as the first pieces of the pollution control equipment were installed, the company engineers inquired into a new technological design of aluminum production that would eliminate most of the adverse environmental impacts of the production. They realized that the Soderberg technology had inherent limits in terms of possibility of adding environmental controls. Their strategy to this limitation was to develop a technological solution that would separate the process of baking the anodes from that of smelting aluminum.

The ZSNP management also responded to the situation by appealing to the state administration to authorize reconstruction of the smelter. They found that in the given structure of roles between the state and the enterprise and the economic regimes within which they operated, any significant action to modernize the smelter required involvement of state authorities that allocated investment funds, assisted with obtaining technology and included modernization of the smelter in the state plan of technological investments. The state administration when presented by the ZSNP with the problem of modernizing the smelter approved the moderniza-

tion by a decree of the Czechoslovak government followed by a similar decree passed by the Slovak Government.

The passing of the Government Decree on modernization of production in Ziar sent a message to the ZSNP management that the Government administration was serious about the project and that the project was a legitimate problem. In the meantime, research efforts of ZSNP engineers brought first fruits of success that further shifted the situation. A new type of a smelting pot was designed and tested successfully.

When the ZSNP managers heard about the Government Decree and about the test results of running the new smelting pot, they were able to start drafting plans of the modernization in the ZSNP. The strategy of modernization was specified in enterprise development plans and submitted for approval to the State Planning Committee, the Federal Ministry of Smelting and Heavy Engineering, and the Slovak Planning Committee.

However, as soon as the first plan of the enterprise modernization was submitted for approval, new information became available which changed perception of the problem. The ZSNP managing director was made aware that it would be possible to acquire a know-how from foreign producers rather than designing their own at home. As a result, he sent let-

ters contacting all the major industry producers to tell them about his search for technological know how and eliciting proposals for cooperation. Most of the industry producers who received these letters responded with offers. When the ZSNP managers heard back from these industry leaders about their interest to conduct business with them, they narrowed down the search and selected three out of the group for a personal visit.

The approach to selecting technology changed again at the beginning of the 1980's when news of high current smelting pots came to the ZSNP. The old strategy of acquiring the technology from one of the three previously selected industrial leaders was discarded. Instead, the supplier of the advanced technology, Norweigan Hydro aluminum (HAL), is contacted and invited to submit a proposal for the technological modernization of the ZSNP.

The ZSNP's proposal got the HAL act. The company found that the ZSNP was seriously interested in acquiring the technology from them and started preparing an acceptable proposal. It also helped the ZSNP convince the branch industry headquarters that the modernization was urgent and that the HAL could supply the right kind of technology.

When the efforts of the ZSNP and the HAL representatives succeeded in persuading the headquarters of the necessity to proceed with modernization and when agreements on technology transfer were signed between the HAL, and Polytechna Prague, the task situation for the ZSNP management again shifted. Now when the decision on technological design was made, the ZSNP management had to focus on implementing the construction of the new smelter line. Since financing of the project was secured by the Government's approval of the modernization, it did not constitute any particular problem. But in the situation of chronic shortages of supplies, the management became mainly concerned about chasing the contractors and the suppliers to deliver and meet their planned targets.

All the while, the Czechoslovak government inquired into its concern with declining economic performance of the country. When the reforms of the 1980's came late, it was surprised by a political development that prevented it from managing the situation in the old way. The revolution of the 1989 dramatically changed the role of the government and brought in a number of new actors while the old ones disappeared in history.

The Czechoslovak government coped with the unsettled situation by launching its efforts for transition to market

economy. The ZSNP along with other enterprises was designated for privatization and the state funding for the modernization of aluminum production in Ziar dried up.

The economic reforms of the 1990's presented the ZSNP managers with radically new problematic situation which quickly reached dimensions of a major crisis. The ZSNP management learned that no more money from the state budget was available for the modernization and that they had to defend their modernization proposal again before the public and the new government who were reluctant to continue the construction.

Following the change in the state support for the modernization of the ZSNP, both the Czechoslovak government and the opposition environmental groups discovered that they would not be able to brush the ZSNP modernization aside easily. The enterprise workers, totaling close to 8,000, changed public perception of the importance of the issue when they established a strike committee and threatened to cease all supplies of aluminum to domestic customers. The situation was also aggravated by growing Slovak nationalism that threatened to split the country.

This demonstration of power and resolve of the ZSNP workers led to a change in perception of the situation. Both the government and the environmental groups realized that the

enterprise once given autonomy from the government, might not be so obedient as it once used to be. The change of roles between the government and the enterprise and the reorganization of economic regime made it possible for the enterprise to seek outside sources of financial support and to sell aluminum to customers of their choice. The enterprise was no longer a captive producer.

In the end, the Czechoslovak Finance Ministry decided it would be better to yield to the pressure and to provide state credit guarantee for a loan that would enable the ZSNP to bail out of its critical financial situation than to insist on its policy of providing no support to industry.

The provision of state credit guarantee changed situation for the domestic banks which were approached by the ZSNP to provide credit. With the state credit guarantee, the ZSNP was perceived as acceptable risk to whom money could be lent. To deal with the new situation, the banks formed a consortium that was able to put together 500 million crowns. Thus the government averted the threat of a worker strike that could have triggered a landslide of strikes similar to those paralyzing economic production in Poland. The domestic banks found that they could do a good business with enterprises when the National Property Fund bailed out the enterprise.

These events changed situation for the workers in the ZSNP who gained more power to force their demands. Soon they had another opportunity to test it when the Slovak Premier Meciar, whom they supported, was about to be forced out of the government. Being aware of the critical importance of continuing state support for their enterprise to bail them out, they realized that they could scare the public out again. Consequently, they formed a new strike committee to go on a one hour strike in support of the Slovak Premier Meciar.

The worker strike in the ZSNP changed political situation for the Premier Meciar. He knew he could count on worker support in the Central Slovakia in his political strategy.

Organized labor entered into the situation on yet another opportunity when the ZSNP management discussed potential investment by Marc Rich & Co. At that time, international trade unions, the AFL-CIO and the British Trade Union Congress, were occupied with workers strike in Ravenswood aluminum plant. They devised a strategy of following the plant's presumed owner, Marc Rich, around the world and into Eastern Europe. They hoped to exert pressure on Rich by warning against him all potential East European enterprises and

appealed to their workers to stop any deal with Marc Rich @ Co.

This action of international trade unions frightened the ZSNP management and its workers. Although they needed the investment money, they decided on the end to withdraw from negotiations with Marc Rich @ Co. and returned the first installment on the promised investment. This decision put them into a position of having to keep searching for another suitable investor. As another strategy, they explored possibility of securing the investment from the HAL who provided the technological know-how for the modernization.

In the meantime, the ZSNP management was dealing not only with the problem of financing the modernization and with the general liberalization of political situation, but also with a change in an ownership structure and organization of the enterprise. The Slovak Privatization Ministry created to privatize Slovak industry transformed the ZSNP into a joint stock company and partly privatized it in the first wave of privatization. The ZSNP management thus found itself in a situation of having a new owner and reporting to stockholders, though the Ministry of Privatization remained the majority owner.

During the same time, the construction companies working on the construction of the smelter grew increasingly dissatisfied with increasing indebtedness of the ZSNP on their contracts. Although they needed the business of building the smelter, they also needed to get paid for their work. When the ZSNP stopped paying them, they responded by threatening to demobilize and leave the site.

While the ZSNP was facing its deep financial crisis, resorting in the last effort to reverting its operating funds into continuation of the modernization program, a new unexpected actor entered the situation.

The London based European Bank for Reconstruction and Development noticed the situation in the ZSNP. It strove to pursue its mandate of supporting economic development in the Central and Eastern Europe in an environmentally sustainable way. It was under the pressure of the public who demanded a quick action on furthering the Central and Eastern European transition. The public was concerned that the EBRD acted slowly and did not execute enough projects in the period of its existence. Under the pressure of this situation, the EBRD contacted the ZSNP and offered assistance with financing the completion of the modernization project.

The entry of the EBRD into the modernization project called for some redefinition of the modernization project design. The EBRD's operating procedures required the project to go through thorough financial, economic, and environmental appraisals. Only facilities that could be profitably operated in an environmentally sustainable way could remain. Further, the new smelter had to be legally separated in order to deal with potential environmental liabilities on the site. Also, new problems of remediating the red mud pile and closing the alumina plant were added.

Both the ZSNP and the EBRD were shaping the project under a keen eye of international environmental groups. These groups found themselves in a situation of trying to exercise direct influence on developmental decision making by monitoring activities of international development banks and corporations. They adopted strategy of reviewing the project documentation in as much detail as it was publicly available, demanding disclosure of other information and writing letters to the EBRD and ZSNP directors expressing their concerns about the project.

This activity of international environmental groups put the EBRD into the situation of having to reconsider the balance between private sector confidentiality and public

accountability for money provided by a government sponsored international development bank. Further, the complexity and uncertainty of the project required a number of conditional measures in cases certain courses of action needed to be pursued later when further information from technical studies become available. Also, the project profitability was open to fluctuation in the international commodity market and to market access to sell aluminum. This was coupled by the controversial "dumping" of aluminum from countries of the former Soviet Union that were overproducing and trying to sell their output in the European Union market.

The European Union facing the situation of excessive imports of aluminum that threatened domestic producers started issuing import quota on aluminum from the former Soviet Union. The EBRD project bankers had to take into account the importance of market access for their project to succeed. As a result, they negotiated a special agreement with the European Union to guarantee market access for aluminum produced in the ZSNP.

As in the her cases, the project loan from the development bank opened door to other investors and commercial banks who entered the scene.

4.3.2. Organizational Learning in Aluminum Plant Modernization

Many activities in the ZSNP case involve complex problem solving. The establishment of the ZSNP is justified as a solution to multiple government objectives. It is a solution to the need to produce the strategically valuable metal within the system of cooperation in COMECON. At the same time, it offers opportunities to provide employment in economically depressed region with traditional skills in metallurgical activity.

Another major problem solving activity involves the modernization process. The first attempt for pollution control takes the form of installing the end of pipe air control equipment. However, because this approach is technologically constrained and opportunities for improvement soon exhausted, other aspects of the problem-setting are explored. The problem solving activity moves in a direction of searching for a new technological design.

At first, domestic technological design is sought by company engineers. They work in this direction to the point of designing and constructing the first smelting pot, but then the problem-setting gets changed. The problem of modernization is reframed through the insight of the directing man-

ager who becomes aware that a new technology could be acquired from abroad rather than developed domestically. However, even this way of exploration of the problem is modified in the process as new information becomes available.

A major shift in the technological problem solving comes about when new high current technologies become available. Because these technologies are superior to those considered before, the management changes their strategy and sets out to acquire the more advanced technology from the HAL.

The technological aspect of the modernization problem gets reframed again when the ZSNP negotiates the loan with the EBRD. During the loan negotiation, new facts become visible that are incorporated into the problem solution. As part of the appraisal process for the loan, a complete audit of environmental pollution and compliance on the site is conducted. This appraisal leads to increased visibility of other sources of pollution which are not addressed by the new technology. In particular, restoration of historical damage on the site, and of the red mud pile in particular, needs to be included in the problem definition and a solution for this broader view of the problem is sought.

Yet another complex problem solving process may be noticed that interlocks with the modernization design. This process

involves international labor unions who are trying to find way of making absentee corporate owners responsible by chasing them around the world. When they get frustrated during their strike in the USA, they try to get even with Marc Rich and Co. by appealing for solidarity with other trade unions of aluminum producers and by chasing Marc Rich into Eastern Europe.

Along with complex problem solving, simpler learning processes may be observed. The workers and management of the ZSNP progressively build skills in producing aluminum. They improve its quality in production and add secondary semi-final manufacturing processes. Through the modernization requirements, the domestic banks improve their skills in financing complex industrial project. They learn to build consortia and fund the project within their limited means.

Observation learning is significant during the period of searching for the technological concept of the modernization project. During this process, the ZSNP engineers visit a number of industrial plants of their competitors to learn about their technology and operation practices.

Benchmarking is yet another type of observation learning intensively used by the industry. Even in the times of the central planning, when comparison on basis of economic effi-

ciency was impossible with advanced western competitors due to the difference in economic regimes, the ZSNP engineers were able to benchmark in terms of technical coefficients of production. They knew their material intensity of production, energy intensity of production, and measures of industrial emissions. These technical coefficients served as a basis for comparison with western producers and their technological processes. As a matter of practice, little comparison was done in terms of market share or financial returns on investment.

The NGO's in the case also learned through observation of western NGO's. The formerly conservative, conservationist Slovak environmental groups transformed after the political liberalization into confrontational special interest pressure groups. For example, the largest group of the Nature Protectors formed a strategic alliance with the Greenpeace. The Slovak NGO's learned from their western counterparts to conduct campaigns against industrial development projects and to stir up public awareness and influence public opinion.

Both the NGO's pressure and the workers strike served as learning stimuli for sensitizing the actors involved to issues surrounding the modernization project. They learned

consequently to respond effectively to any related questions.

The workers strike was also an instance of instrumental learning. The workers were reinforced in their strategy when it succeeded. It did not last long before they used it again to support the Slovak premier.

Another type of simple association learning, classical conditioning can be found throughout the cases. First, after the initial period of development euphoria, the local community, the plant managers, and even the government officials learned to associate industrial development with environmental pollution. The large scale industrial plants built in the initial zeal became to be known to produce significant amounts of pollution, particularly as they were aging and their capital equipment was getting obsolete.

Next, approval of the modernization project in the system of centralized planning was associated with access to sources of government financing through investment subsidies. Behavioral expectations were learned by the plant managers that the government would be providing the finance as long as its approval of the modernization lasts.

Some of these conditioned responses and learned practices of the centralized planning system had to be unlearned

through habituation and forgetting after the political and economic change of the 1990's. Old responses such as chasing deliveries of supplies and government approval rather than focusing on markets and clients had to be gradually eliminated through habituation. However, the most significant aspect of departing with the old concerned forgetting the learned helplessness of the enterprise managers and workers. After a long period of total dependence on government decision making and passive execution of hierarchically determined actions, the ZSNP had to show initiative to create its own future. The ability to help themselves was a critical step on a way to successful completion of the modernization project.

The complex process of structuring the development loan with the EBRD required from all the involved actors to learn chaining the transaction in the right order. They had to find the correct sequence of actions to pass through in order to complete the deal. The negotiations involved a large number of parties that all had to be brought along into the final agreement. Step by step, the transaction was finally completed.

Throughout the project development period, the government's inquiry into economic performance of the country

occasionally resulted in structural economic and political reforms. The most dramatic reforms took place in 1989 involving complete rejection of the old centralized system of economic planning and political communist regime. For the actors involved in designing the modernization projects, these periods of change in the structural context lead to learning to navigate in a new situation. The above instances of habituation and forgetting all were prerequisite for a successful learning to navigate in the new structural context. The actors found themselves suddenly in a new situation in relation to their structural context. They had to learn to place the novel in the context, orient themselves to new situations, form new concepts, and interpret novelty by typifying the situations.

4.3.3. Efficient Coupling in Aluminum Plant Modernization

The efficient coupling in this case can be characterized as a *managed coupling* - a managed company restructuring with multiple environmental improvements.

The environmental improvements on this project are many although in contrast with the SEPAP case, no specific sub-

stance is eliminated from the production process or environmental qualities of the product improved. The closing down of old smelters and ammonia plant dramatically reduces emissions of dust, fluoride, and tars. The release of emissions is reduced by closing down the old plants and building a new one with a different technological process. By the same act, occupational health and safety is improved because the new plant has much better ventilation and emissions are contained inside the closed production processes.

As a condition of the EBRD loan, historical damage is being remediated. Particularly, the red mud pile is being contained and insulated. The amount of money required for the remediation comprises only a fraction of the cost of the building of the new smelter. Further, it is tied to taxes generated from the production that may be applied towards environmental remediation if the Slovak Government agrees.

The environmental improvements on the ZSNP site have no significant regional impacts. All of the pollution is of local nature with the exception of some leaks into the Hron River. The River Hron empties into international Danube River.

Company profitability improves through complete restructuring of the operations and the creation of the new subsid-

iary SLOVALCO. Operating costs of SLOVALCO will decline because the new smelter is more efficient. It uses less energy and labor per unit of output thus saving on costs. Capital costs of the modernization are large, covered only partially by the loan from the EBRD. Product price remains the same set at the level of international commodity market. Increased financial returns are expected from selling the larger production volume of aluminum if demand increases and prices grow. Thus the economic improvement is significantly contingent on expected upturn in demand for aluminum.

Organizational environment of this coupling appears semi-competitive. The firm is in a competitive industry for sale of its product, but it receives cheap inputs of captive labor and publicly regulated electricity. The ZSNP is still majority owned by the Slovak Privatization Fund and thus close to government intervention and support should the company be in trouble.

Returns to the regional economy come mainly from the preservation of employment opportunities and tax base generation. Some downstream aluminum processing can also be found. The construction of the smelter will provide short term contracts for local construction companies.

The attachment of the coupling seems midway between economy and the environment. The economic returns make environmental cleanup and compliance possible. On the other hand, the necessary funding and the state sovereign guarantee provided by the Slovak Government are partially legitimized by the significant environmental improvements expected to result from the project.

The time dimension of the coupling is also medium term. The company will have to repay its loan in seven years while the scheduled environmental improvements will take place immediately.

Chapter 5

CONCLUSIONS

The case analysis shows that the actors in the three industrial modernization projects managed to improve environmental performance in a climate of general economic decline, overcame the *learned helplessness* they had been trained to assume under the communist regime, and provided themselves with a viable future, all by learning to achieve efficient coupling in their modernization projects.

Although learning efficient coupling may superficially be seen as a process of instrumental learning, in which means and ends, methods and goals, are externally related to each other, the process is complicated by problems of boundary setting, self-referentiality and interaction effects.

In a simple version of the instrumental model there are three actors - the enterprise, the development bank, and the government. These actors pursue the task of achieving environmental and economic benefits against the background of each other or as three actors solving problems independently. The outcome - achievement of economic and environmental benefits - is clearly distinguishable from the process of its achievement so that the actors can establish

standards of achievement with well defined performance criteria, i.e. the actors can evaluate the instrumental value of their actions by measuring their contribution to achieving the outcome. Moreover, the contributions of actors to environmental and economic benefits can be independently determined.

Much as this simple model is appealing in its clarity, the case analysis shows some significant complications.

Boundary Setting

For one, any specification of environmental and economic benefits is contingent on spatial and temporal boundaries set for the system under consideration. The perception of a positive coupling between environmental and economic variables is sensitive to boundary setting for the system that includes those variables. The scaling of activities over time, space, and institutional regimes may dramatically change the nature of the linkage. Economic benefits accruing to a private firm may become losses for a regional economy when possible hidden subsidies and environmental externalities are included in consideration. Also, economic benefits achieved at a given time may be coupled with short term environmental benefits, but long term environmental costs. The

specification of joint goals or mutual benefits is necessarily situation bound.

For example, in the CEZ case, both the German and the Austrian governments found it cheaper to spend money on cleaning up Czech power plants across the border rather than continue suffering damage to their forests. This decision could only be taken when the administrative distinction between two countries was suspended and cost of pollution was estimated across national boundaries, over the larger geographic region.

Conditions of Interaction

At a higher level of complexity, the project outcomes of efficient couplings are shaped in and emerge out of a field of interaction of the major social actors each inquiring into their own particular problematic situation. Whether or not efficient couplings arise out of that field of interaction, and what their nature is, depends on the *conditions of interaction* that hold in a given modernization project and on the processes by which the actors learn in and from a project (Figure 5.1 on page 172).

The main conditions of interaction that appear to have shaped the outcome are the following: the institutional

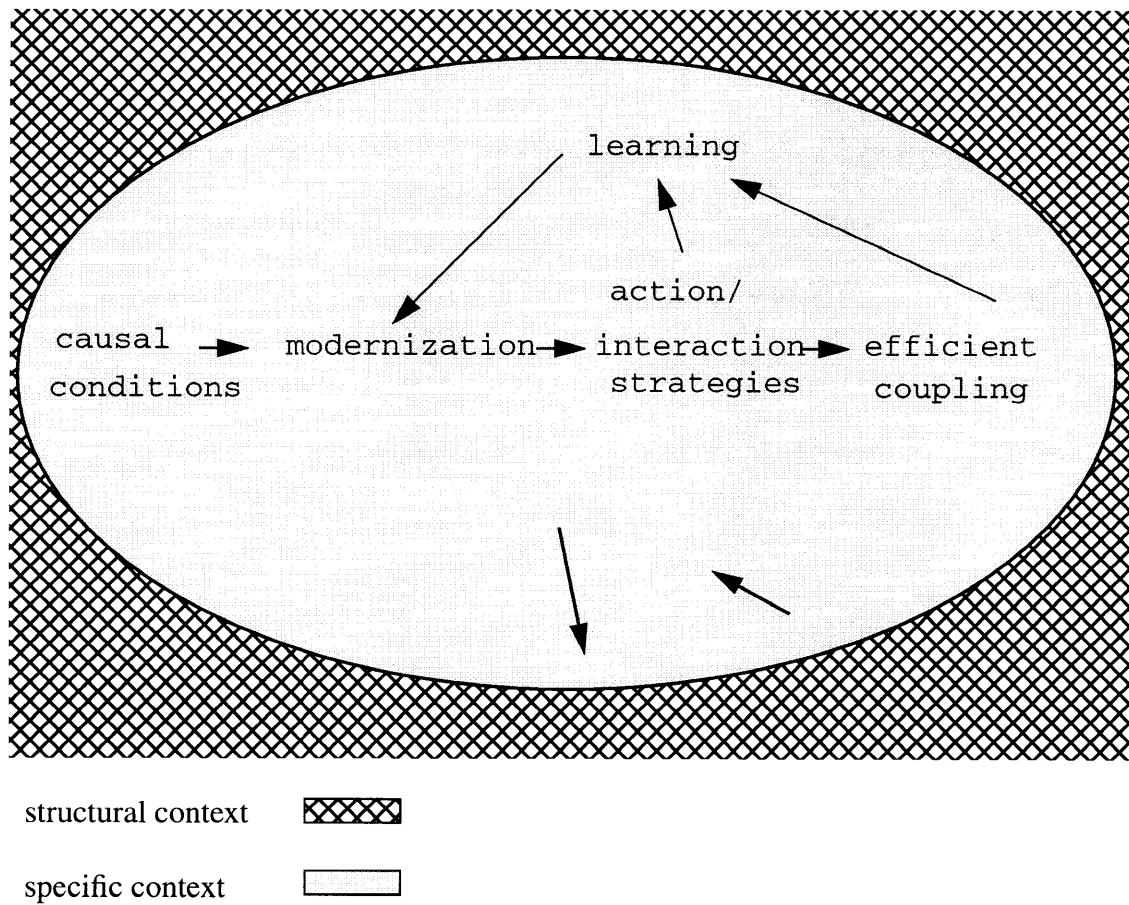


Figure 5.1: Learning Efficient Coupling

regime, the stage of centrality of green, technological advance, cast of actors, problem ownership, problem attention, environmental complexity, technological complexity, financial complexity, motivating forces, external pressures, and organizational environment. These conditions of interaction can be subdivided into causal conditions, specific context and social structural context. Consequences of actions taken by actors in a field of interaction, or shifts in the environment external to that field, may cause changes in the

specific structural context, or become causes of new problems, thus bringing about changes that affect the production of efficient couplings.

The specific context represents the specific features and relationships of the field of interaction involved in a given interaction process. For example, the cast of actors in the SEPAP case consisted of the EBRD, the SEPAP management, AssiDoman, Stratton Investment, Czech Environmental Inspection, local community of Steti, and domestic banks.

The structural context of the process discussed in the three cases includes the institutional transformation in Eastern and Central Europe and the rising *centrality of green*, both of which affected worldwide climate of opinion during the time period in which the modernization stories were unfolding. These features of the larger context affected market demand for product, technology, supply, and public opinion, all of which, in turn, shaped governmental policies of regulation and subsidy, which thereby influenced the perceived meanings and measures of *economic benefit*, and the conditions for achieving *economic benefit*, and ultimately, the profitability of the firms themselves.

The simple model of instrumental achievement of efficient coupling is further complicated by the degree to which vari-

ous institutional actors within the field of organizations - for example firms, development banks, governments - actually *modified* conditions essential to efficient coupling of economic and environmental benefits constituting thus a self-fulfilling prophecies.

For example, the problem of the ZSNP modernization gained increased *attention* from managers and policy makers as a result of the action of the ZSNP workers who went on strike to win a loan guarantee from the Czechoslovak Ministry of Finance arguing that the project was financially viable. Increased attention to the ZSNP problem stimulated the Czechoslovak Government and later the Slovak Government to approve the modernization project and to provide the guarantees for loans. When the loan guarantees were obtained, the risk of the financial transactions was reduced to the point that commercial banks found it profitable to loan money to the ZSNP to support the continuation of its modernization efforts. As a result of modification of conditions of interaction, the project became financially viable.

Similarly, the *ownership* of the problem was passed from the national government during the period of centralized planning to enterprise managers during the privatization period and on to the EBRD when the ZSNP hit the bottom of its

financial crisis. The EBRD, while exercising dominant influence over the project, was able to secure long term contracts for electricity from the Slovak energy utility and to negotiate access rights for ZSNP produced aluminum to the managed European market. Thus project bankers successfully negotiated both prices of critical inputs and access to market for the output, thereby making the modernization project commercially profitable. They achieved this economic result with the help of the Slovak Government and the European Union who were impressed, among other things, by the promised environmental benefits of the ZSNP modernization.

Self-Referentiality

The recognition of *mutual effect* introduces into the analysis a significant self-referentiality between the variables of environment and economy as well as between the process of interaction and the outcome. The reason for this self-referentiality is found in the phenomenon of *collapse* between environment and economy in the coupling mechanism that occurs in all three researched instances - the market coupling, the monopoly coupling, and the managed coupling.

We often find that one driver (for example, centrality of green) propels two processes¹. Further, the processes are

valued in terms of means/ends relationship because they achieve two outcomes simultaneously¹. In such situations, speaking of the environmental benefit already implies a reference to the economic benefit. Similarly, speaking of environmental values driving the process already implies a reference to economic values (Figure 5.2:).

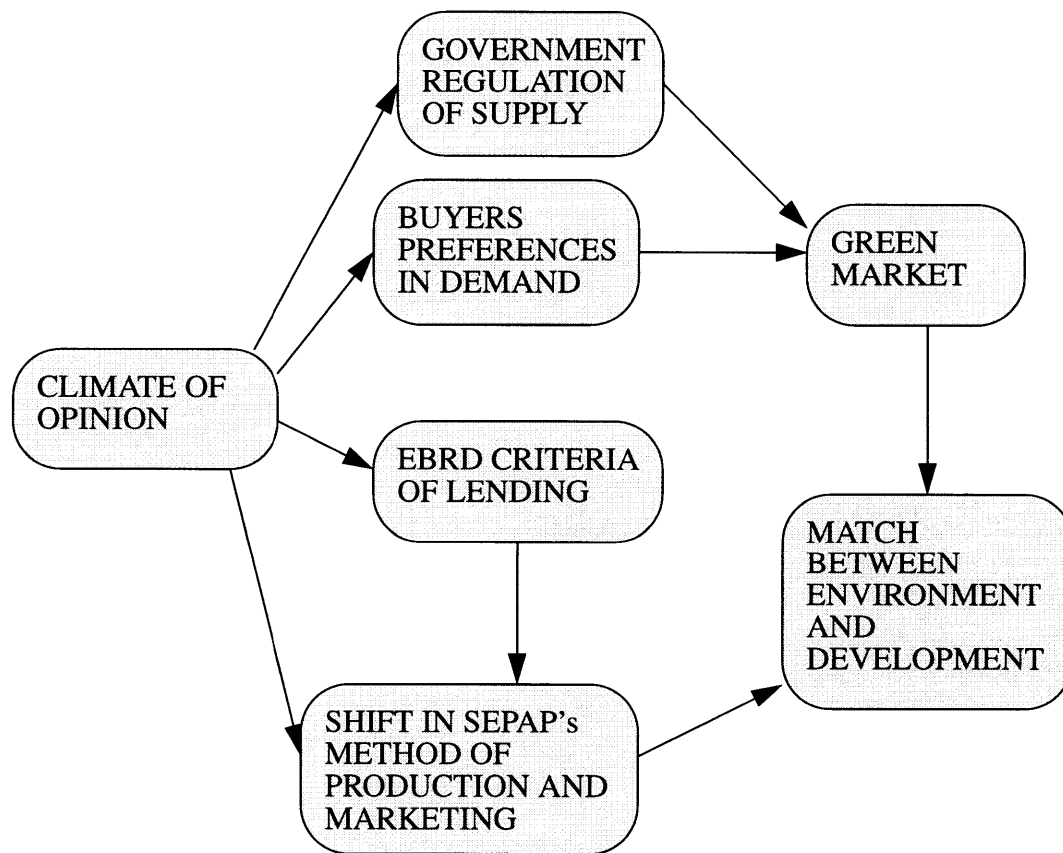


Figure 5.2: Self-Referentiality in SEPAP's Case

1. This is similar to what engineering literature calls common-environment coupling. Common-environment coupling is a type of coupling in which two software modules access a common data area (page 94)

1. This is similar to what engineering literature calls common-environment coupling. Common-environment coupling is a type of coupling in which two software modules access a common data area (page 94)

In the SEPAP case, for example, the rising *centrality of green* in neighboring Germany led to the rise of *green markets* for chlorine-free paper. At the same time, popular opinion combined with the pressure campaigns of Greenpeace and other NGO's resulted in the German Government's passing a law restricting craft pulp production in Germany. Due to these changes in public opinion and legislation, the market for pulp changed on both the supply and demand side, in Germany. Furthermore, *green sentiments* contributed to the ultimate breakdown of the system of planned economy in Central and Eastern Europe, as a consequence of which the institution of administered trade was abolished and production enterprises were privatized. As a consequence of these intermediate outcomes, SEPAP found it profitable to reach out and sell its product in Germany. In addition, this strategic business orientation to entering a new *green market* was combined with the expansion of production and the elimination of chlorine from the production process. As a consequence of the context shifts, the meaning of *economic benefit* was transformed in such a way as to make green production profitable.

Learning Effects

A wealth of learning episodes occurred during the project design processes in our three cases. These shaped the outcomes of the interactions and complicated the process by inducing interaction effects. Thus, we need to ask "who acts" in these stories and "who learns"? Are the cases best understood as being about how firms learned to achieve efficient coupling within the contexts of their organizational fields? Or how multiple firms within those fields learned individually, to enable the modernization projects to achieve efficient coupling? And if the latter, whether the learning in question was in the nature of a *spewed out consequence* of the interaction of individual actors' learning, or whether it represented a more concerted effort on the part of institutions that shared overarching objectives?

Although there are different types of learning, each of them belongs to an actor. For example, I found *problem solving* in the efforts of national governments when they first established the three enterprises, and again in the efforts of the enterprises when they struggled with the increasing environmental pollution and the declining technological viability of their plants. I also found *problem reframing*. The problems first discovered were often reframed. For example,

the ZSNP's decision to develop new aluminum smelting technology domestically was reframed by the insight of the director that the technology could be acquired from abroad.

Next, I found *skill acquisition* such as the ZSNP's learning to produce aluminum, or the SEPAP's learning to function in its new role of private enterprise. More, *associative learning* was common in the form of *classical conditioning* such as for example the town of Steti and the town of Ziar learning to associate the operation of the plant with jobs and the well being of the citizens.

Observation learning was apparent, for example, in the visit of the engineers from ZSNP abroad when they searched for the new technology or in the NGO's imitation of western environmental groups after the transition.

Navigation into a new situation was faced by all the enterprises and governments in the period of institutional change when they were learning to perform new roles. The enterprises, development banks and government agencies passed through sensitization to environmental problems when the newly acquired freedom led the public to express their discontent. Also, *habituation* of old responses was common such as when the enterprises no longer needed to chase shortage of supplies or justify their operations in terms of

social purpose. Further they had to *learn new concepts* such as marketing or financial management. Commonly these new enterprise roles were acquired by hiring experienced western managers to perform them. *Forgetting their trained helplessness* was key to developing a successful strategy on the part of the enterprise managers during the period of transition.

The most significant process of learning which emerged from this interaction seems to be the application of *aikido* - a strategy that emphasizes blending of environmental actions with the flow of economic development rather than confronting the economic development with hard techniques such as command-and-control regulation. The other important learning process was the finding the correct *chaining* of steps in the modernization strategy. Both of these processes are the best exemplified in the SEPAP's case. However, the ability to *deutero learn* is also important. This ability leads the CEZ to the forefront of setting industry benchmarks rather than adopting them.

Although learning in the above examples belongs to individual actors, it needs to be determined whether the organizations solved problems individually, as in the simple instrumental model. It is possible that they rather acted in concerted action through active collaboration. Alterna-

tively, they could act through distributed action, each one pursuing the goal independently without cooperation. But the last alternative which is endorsed in this dissertation, *learning as interaction*, views the actors as having different goals, even though there is a significant overlap in these goals. The set of actors is seen to interact in such a way as to achieve the outcome through an "interaction effect."

The learning observed in my cases is interactive. For one thing, consequences of action by one actor lead to new problems or opportunities perceived by that actor, or by others. For example, the government inquires into its problems of furthering economic development and improving environmental quality. As a solution to this problem, they establish the industrial enterprises. When the ZSNP, the SEPAP, and the CEZ start learning to deal with the impacts of their production on the environment, they also press the government to change some of the aspects of the institutional regime in which they act. The government, in turn, becomes increasingly aware of unintended consequences of its policies on the environment, and inquires further into the ways of changing its policies.

When the economic regime changes, the industrial enterprise suddenly faces new opportunities which it learns to utilize - the CEZ learns to seize the monopoly opportunity to purchase the scrubbers, the SEPAP learns to utilize its open access to green markets to eliminate chlorine, and the ZSNP learns to utilize its regional significance to manage a continuation of its modernization.

Learning to achieve a goal may lead to *clearing the screen* of attention and to consequent discovery of new problems that were beyond the threshold of attention before. For example, the SEPAP in its early steps of modernization builds a water treatment plant and installs a regeneration boiler. The acquisition of these pieces of pollution control equipment reduces emissions of organic substances (lignin) into the river. However, the success in reducing release of organic effluents shifts attention to the continued release of chlorinated substances that cannot be treated in the water treatment plant or regenerated in the boiler.

The research findings summarized above support my argument about the need for examining the processual, dynamic character of the environment-development relationship and the

importance of interaction, change, conflict, and organizational shaping of action in organizing thought about environment and development.

The research also shows that although trade-offs will always remain, there are still forms of development that lead to mutual benefits. To some extent, these mutual benefits are not "natural" but rather managed by actions of actors who can reshape the conditions of interaction. This reshaping may be a result of a long term evolution, of a response to consequences of other actions, or of intentional design.

It is thus possible at the level of national or international policy deliberately to create conditions favorable to learning efficient coupling. This requires a movement to a new, more sophisticated level of decision making in environmental protection that will take into account the dynamic, processual character of the environment and development relationship. A step in this direction will be an introduction of voluntary industry standards for environmental management and building a regulatory system that works with the flow of the market.

An important step in this direction seems to be the linking of total quality management approaches of the 1980's to

environmental management systems of the 1990's. At the time of completing this thesis, representatives of 60 governments of the world and of the private sector are negotiating voluntary standards for environmental management systems that will be codified by the International Standard Organization for the use of industry and regulatory government agencies. These standards, known as ISO 14000, represent the new direction towards integrating sustainable development principles into the free market system and towards avoiding non-tariff barriers and regulatory impediments to trade.

After the momentum towards global markets and international trade agreements has prompted a broad cross-section of companies to adopt international consensus standards on Quality Management (ISO 9000), the opportunity created by these drivers coupled with *greening* of global markets and growing awareness of cross-border pollution impacts now exists to adopt similar standards for environmental quality. As these standards are being adopted, the state environmental agencies will face a new challenge, but also a great opportunity - to work as partners with companies using these new standards to achieve more effectively our environmental protection goals. The new ISO 14000 standards on Environmental Management Systems are an important step in linking

environmental policy to private sector attempts to learn to achieve efficient coupling.

Appendix A:

DESCRIPTIVE CASES OF ORGANIZATIONAL INQUIRY INTO ENVIRONMENT AND DEVELOP- MENT

A.1 The Czechoslovak Government's Inquiry into Environment and Development

A.1.1. Government Inquiry into Economic Performance

The modern economic history of the Czech and Slovak economic reforms can be drawn from after the World War II period. In 1945, Czechoslovakia was the only country in the Soviet sphere of influence that was able to base its socialization efforts on a democratic system. The Czechoslovak socialization took a very specific course. It was conducted under the patronage of a democratic president who enjoyed a nationwide authority and under a pluralist government of one communist, two socialist, and two bourgeois parties. Although key industries were nationalized, private sector still played an important role in all areas of the economy. That transitory period was seen later as the expression of an European road to socialism which combined political democracy with economic democracy.

Economically, this system was a market economy in which both state and private enterprise were run by professionally competent managers who were guided by market criteria while at the same time respecting political and social priorities of a central, indicative plan. This way of organizing economy was first applied during the first two year plan of economic revival (1947-48), and it remained valid until a short time after the Communist party seized full and uncontrolled power, both economic and political, in February 1948.

After the communist takeover, it took some time before the Soviet model of centralized planning was adopted. The first five-year plan (1949-53) drafted by the communist planners was created with priorities in the production of consumer goods and with balanced trade relations both with the East and with the traditional Western markets. Although the five-year plan already signified a centralization of decision-making processes, in its initial stages it was based on so-called counter planning by which each enterprise reacted to the directives received from their superior organs. Economic units still had a considerable measure of authority and independence. They were broadly applying intraenterprise management methods which had been successfully used for a

number of years by the Bata enterprises (a Czechoslovak version of Fordism).

This first economic model was based on a conviction that the conditions of an industrially advanced and democratic European country did not permit an application of the Soviet command model and that it was impossible to transplant an alien system, created for entirely different purposes, to a dissimilar situation. In this respect, the economic practice corresponded with the theory of a democratic road to socialism.

The idea of a specific Czechoslovak road to socialism suffered its first blow in the summer of 1947 when Stalin forced Czechoslovakia to withdraw from Marshall Plan negotiations. The second blow came when the Cominform criticized the French and Italian Communist parties for their attempt at achieving socialism by democratic methods. The final blow came in the summer of 1948 in the Cominform resolution on Yugoslavia.

The Soviet model of socialism came to Czechoslovakia in 1950 and 1951. In February 1950, the targets of the five-year plan were substantially increased for the first time (so called mobilization of production) and priorities were shifted from consumer goods to investment goods. The follow-

ing year, under the impact of the Korean War and deteriorating world situation, the Soviet Union forced Czechoslovakia not only sharply to step up the pace of growth of its heavy industry (from 70 percent of the original version to 133 percent in the final version), but also to change the industry's structure in favor of metallurgy and heavy machinery (armaments industry and investment goods). Along with these structural changes essentially reconverting to war economy, the Soviet command economic system was imposed in Czechoslovakia. Thus Czechoslovakia became a steel power without owning any iron ore.

The main objective of the Stalinist strategy of economic development was to achieve industrialization with great stress on heavy industry in the shortest time possible. The Soviet planners found that the required high growth rates, which in practice meant high investment ratios and high growth rates in employment, could not be achieved by market forces. Also, the labor force available for implementation of the ambitious industrialization plans did not have the required skills. In a situation of shortage of specialists and of experienced managers, it seemed reasonable to use the scarce resources of managerial talents primarily in the center and to manage enterprises by orders. In this way, the

Soviet planners succeeded in combining their goals of economic development with Marx' belief that the economy of the future state would be run as a marketless economy.

The planning system in the centralized economy fulfilled most functions which the market mechanism fulfills in a market economy. The state economic plan coordinated the economic activity of enterprises of different sectors of economy, handled the distribution of producer and consumer goods and concerned itself with equilibrium in the macro- and microsphere. Also, its role was to ensure price stability, full employment and proper wage differentials.

All important macroeconomic decisions were made by the central planners and incorporated into the plans. The planners determined the targets for the distribution of national income between consumption and accumulation as well as for the distribution of the consumption fund into personal and collective consumption, and for the distribution of investment funds between productive and non-productive spheres, and between sectors of the economy. The growth rate of incomes of individual socioeconomic groups and of incomes in individual sectors of the economy, as well as the distribution of collective consumption were planned. The rate of

growth of the economy and the growth rate of individual sectors were to a great degree determined.

Production targets for the whole economy were disaggregated through the channels of management down to enterprises. Thus microeconomic decisions rested also in the hands of central authorities. The plan of an enterprise in terms of the size of output, profit, productivity and other indicators corresponded to the plan of the supervisory authority. Each enterprise had a certain role in the structure of the national economy. It was required to produce certain products and not others. The system had no role for competition.

Technological innovation was also planned. Research and development was put into the hands of centralized research and development institutes under the rationale that in a socialist country there was no room for technological secrecy. Enterprises were assigned targets for development of technology.

In order to be able to produce the assigned targets, enterprises, when they were established, got fixed assets, which were the property of the state, and working capital. If the planners believed that new capital was needed, it was allocated to enterprises. Producer goods were also allocated

to enterprises. The planners also determined the size of the work force and wages to be paid and they helped enterprises to get the needed labor.

To make sure that the demand for inputs resulting from the planned size of production was in balance with the available or possible supply, the plan had to go through material balancing. The system of balancing as a method of planning also included financial balancing and manpower balancing. Producer goods were allocated to enterprises in the sense that a supplier was assigned to them. Thus the horizontal links between supplier and buyer were determined from above.

Foreign trade was also planned. Imports were the point of departure in planning. Their purpose was to overcome bottlenecks in the economy, ensure new technology which was of great importance to the objectives of the plan but could not be produced at home for lack of know-how, and goods which could not be produced at home for geographical reasons. Exports were primarily intended as repayments for imports. Domestic enterprises were not allowed to trade directly with foreign firms. This activity was reserved for special enterprises, so called foreign trade corporations, which were managed by the ministry of foreign trade.

Prices were not result of a market but were set up administratively, usually at the level of production costs plus some small profit. When new prices were set, their level was planned with the objective of clearing the market. But once they were set, they remained stable for a long time regardless of change in supply and demand. There were three independent price circuits: wholesale prices, retail prices, and foreign trade prices. Wholesale prices performed more of an accounting function; they were used primarily as a yardstick of plan fulfillment. Rarely were they used to influence the decision making of enterprises about choices of inputs.

Bank credit was planned and extended for certain purposes. The interest rate was also set by planners. It was not viewed as a price for the use of credit and it influenced very little the extension of credit or investment decisions.

Physical planning and management was of a paramount importance much greater than financial management. Material balancing was one important element of physical planning. Other parts of physical planning lied in the assignment of targets in physical units, setting norms of labor intensity and determining technical coefficients of production.

The centralized system of economic management was intended to focus attention of enterprises fully on their productive

function. Domestic production in the state sector as well as in the cooperative sector was separated from consumption and from foreign markets. Signals from foreign markets and from consumers had no direct effect on production. This effect was achieved by separation of different price circuits. Wholesale prices were separated from retail prices in the sense that the former could rise without affecting the latter. The separation of wholesale and retail prices made the separation of production from consumption possible because the fulfillment of plan targets was measured in constant wholesale prices. Because this was so, the only thing enterprises were to be concerned with was the fulfillment of the plan. Consumer's preferences did not affect their well being. On the other hand, this arrangement shielded consumers from effects of inflation.

The separation of domestic prices from foreign market prices followed aims similar to those of the separation of wholesale and retail prices. It also sheltered domestic producers from world market pressure, including imported inflation. Domestic producers sold their products earmarked for foreign markets to foreign trade corporations at domestic prices. Possible losses in foreign trade exchange were financed from a special budgetary fund and possible profits

were channelled back into this fund. Imported products were then sold to domestic producers at prices equivalent to domestic prices.

The system of centralized economic management was complemented with hierarchical industrial structure which facilitated the handling down of assignments and the control of their implementation by the center. This organizational structure in the form of a pyramid was called production economic units in the Czechoslovak case. It meant that industry was divided into many branches and enterprises were associated in production economic units within their particular industrial branch. One or more branches were managed by a ministry in all their important activities through its sectoral and functional departments. The ministry passed its orders on to the directorate of enterprise association, the production economic unit headquarters, who then transmitted them to individual enterprises.

The system of centralized management had some obvious advantages. Firstly, it had the advantage of a quick mobilization of resources for certain priority projects. Secondly, being a supply (resource) constrained system, it had a tendency to full employment of resources, including human ones.

Lastly, the system was arranged in such a way that open inflation could easily be held within defined limits.

But the disadvantages of the system of the centralized management were more numerous. In brief, the system was inefficient, inflexible, hampered innovation, generated shortages and lead to frequent market disequilibria. Since in the socialist system demand was insatiable, the only constraint on increase in production was supply of resources. Therefore, the economic system was a resource constrained system.

Some of the disadvantages of the economic system were connected with the predicament of the central planners known well in the Western literature on scientific management. The planners needed to poses a full knowledge of the needs and opportunities of the economy and of productive capacity of the enterprises in order to predetermine the plan. This very requirement made their planning inflexible for adaptation to sudden shocks and surprises.

Further, the central planners needed to be able to enforce the planned targets. The setting of targets was not a one sided process, but a process of bargaining between enterprise managers and the planners. The enterprise managers were interested in being given soft targets in order to

buffer themselves against fluctuations in productivity and uncertainty created by shortages. They also bargained for an allocation of maximum material inputs and labor. To this end, they tried to understate the output capacity of their enterprises and conceal their reserves.

The central planners knowing these tactics and driven by ambitious plans, resorted to a simple rule - they tried to impose on the enterprise taut plans by increasing the targets by a certain percentage each year above the level achieved in the previous year. The managers responded by abusing quantitative indicators of success which measured fulfillment of the plan. Managers tended to utilize all the loopholes possible in the system in order to fulfill the plan regardless of social cost and quality of products. Further, the logic of the system of the performance indicators was that their number constantly grew. Their large number impeded the initiative of enterprises with negative consequences for innovation.

Centralization of decisions about investment activities, especially the financing of investment projects from the state budget had necessarily to be a source of waste. Resources were not allocated on the basis of price fluctuation and profit expectations, but on the basis of the plan.

The enterprises were obliged to surrender the so-called remainder of profit to the state budget, and the same was true about the amortization fund. The central planners distributed funds for investment according to the objectives of the plan and not according to performance. In practice, enterprises that produced large profit might not have been allocated funds for investment while those that did not make profit might have received investment funds. More, the central distribution of investment was governed very little by efficiency criteria and was much influenced by political considerations. Enterprises did not have to repay the funds or even pay interest on them. The funds represented budgetary grants.

Czechoslovak reform economists made a particular contribution to the theory of centralized economic management. They began to differentiate between extensive and intensive economic growth. They argued that extensive growth was based on two sources: expansion of capital, and expansion of the labor force. Extensive growth was typical of industrialization not only in the nineteenth but also in the twentieth century. However, they stressed, development during postindustrialization took place through intensive economic growth based on more effective utilization of capital and the labor

force, and particularly on the application of scientific and technological progress, on higher qualifications for producers, and on a better organization of production and exchange. The reformists argued that it was characteristic for the COMECON countries that their economic growth was of a manifestly extensive nature and that they were incapable of fully utilizing the intensive elements of growth.

As the shortcomings of the centralized system of economic management were becoming apparent, they gradually created need for a reform. Three general types of reform were possible and tried out in various socialist countries. The first type of economic reform, that of improving the system of centralized planning, was based on the belief that the nonmarket, command economic system was essentially good and that there was no reason to change it. It should only be improved by overcoming centralization and otherwise adjusting the directive plan targets.

The second type of economic reform was an attempt to combine centralization and decentralization. Instead of relying exclusively on central decision-making, the reformers argued that central decision-making would only apply to macroeconomic problems. An obligatory central plan would remain, but the directives through which it was implemented would gradu-

ally be replaced by instruments of economic regulation. Both long term fiscal instruments and immediate price instruments were to be used to stimulate enterprise behavior in a desired direction.

The third type of economic reform proceeded from the assumption that the nonmarket economic system was essentially bad. Partial reforms and improvements were considered not enough, and the only way to an effective economic development was believed to be a transformation of the system. The alternative would be a system based on a synthesis of plan and market in which the plan would be supplemented by the market. The plan would not be a directive plan, but an indicative one, foreseeing future structural changes and steering economic units toward desired social aims.

In Czechoslovakia, some relaxation of the centralist drive came only with the change of Soviet policy after the death of Stalin in the summer 1953. Consequently, improvements were sought within the framework of the command system to repair excesses of the first five-year plan. But in the second half of the 1950's there occurred the first substantial increase of capital-input ratio signaling declining efficiency of the national economy.

In order to counteract this trend, the first economic reform was launched in 1958 and 1959. The reform was based on three principles: (i) a strengthening of long-term (fifteen-year) and medium term (five-year) plans at the expense of short-term (one-year) plans; (ii) partial decentralization (primarily in the investment area) from the ministries to production economic units; (iii) steering the material interests of the producers to the formation and acceptance of optimum plans instead of quantitative overfilling of low plans.

Simultaneously, industry was being organized into so called production economic units. This strategy represented an attempt to amalgamate enterprises into larger bodies and possibly to entrust strong enterprises with an organizational and directing role within the framework of their branches. The effort at combining the interests of the enterprises with effective investment was an attempt to stop the growth of the incremental capital-output ratio. The effort at combining the material interest of the enterprises with the creation of optimal plans was an attempt to eliminate disproportions from the central plan, to make its targets more realistic, and to prevent further deepening of the imbalance. The emphasis on long-term plans and their stabil-

ity was to create a favorable situation for long-term interests of the enterprises prevailing over their immediate interests so that the enterprises would create conditions for a future effective production.

Although the principles of the reform seem essentially rational and logical, the reform met dismal failure in three years. The reason for the failure was not only that the principles could not work in the otherwise intact command system, but that there were also three outside forces at work. Firstly, enterprises were forced to change their production programs abruptly several times when orders for the foreign trade with other socialist countries changed. The Soviet Union several times unexpectedly changed its economic concept of priorities and China annulled its original orders after the Sino-Soviet split. These two events totally disrupted the assumption that long-term plans and production programs would be stable and optimal.

Second factor inhibiting success of the reform was political. In the last sweep of Stalinism, the Czechoslovak government determined to exercise political purges to secure loyalty of citizens. Thousands of people lost their jobs and many enterprises lost their qualified managers. The authors of the subsequent reforms learned that the economic system

could not be reformed without a reform of the political system.

The last factor undermining the reform was the unrealistic nature of the plan for 1961-65. The third five-year plan was derived from a fifteen-year prognosis. The new broad wave of investment required for its achievement was quite beyond the capabilities of the Czechoslovak economy. As soon as the first difficulties of the reform began to appear, caused by the changes in external economic relations, by unrealistic investments, and by adverse weather conditions, the power center reacted not only by canceling the third five-year plan but also by a return to the centralistic methods of management of the early 1950's. But the failure of the Czechoslovak reform of the second type, which ended in the economic crisis of 1963-64, pushed the reform thinking one step further.

Following their negative experience with the second type of the economic reform, the Czechoslovak reform economists started to work on the third type of a reform which ultimately lead to the events of the Prague Spring in 1968. The proposal of the 1964-1968 reform was originally the work of a group of economists and theoreticians who gathered around the Economic Institute of the Czechoslovak Academy of Sci-

ence. The leader and spokesman for the group of reformers was Ota Sik who was a member of both the Central Committee of the Communist Party and its economic commission.

The reform proposal of the group of economists led by Professor Sik was based on the following fifteen principles (in Sulecky 1972):

- The plan as an external mechanism of the functioning of economy must be supplemented by a restoration of the market as an internal, self-regulating mechanism of the functioning of a modern socialist economy.
- In the future, the plan should determine only the basic macroeconomic development on the basis of an analysis of developing trends of technology, production, economic requirements, and overall social needs.
- The enterprises must be granted a measure of autonomy which will enable them to react to the changes of production conditions and of the market; therefore, they must not be subject to limitations in the form of directive plan targets.
- The plan directives will be replaced by economic regulation. The central planning organ shall optimize economic proportions, manage and regulate the redistri-

bution of enterprise incomes, regulate credits, interest, taxes, depreciation, and so forth, through legal norms which will be identical for all enterprises. Equal rights shall be applied to unequal subjects. The rules of the game must be stable and long-range so that the enterprises may be guided by them in deciding on their own future.

- The ministries lose their *raison d'être* as directing bodies. The specialized ministries should be abolished because their functions will be taken over by enterprise associations.
- The relationships between the enterprises and organs of state lose their nature of subordination and superiority. They will be delineated by a law which will stipulate the rights and responsibilities of both sides and will grant the enterprises a right to act in their own interest and to undertake any steps which are not in conflict with the law.
- Foreign trade will be tied to production. The concept of the monopoly in foreign trade will be revised, and foreign business transactions will be decentralized to the enterprise associations or to the enterprises.
- The enterprise associations will not replace the ministries in the sense that they would become superior organs to the member enterprises. It is, rather, a mat-

ter of associating for the purpose of achieving or promoting the economic goals of a group of enterprises. Membership should not be obligatory; the enterprise should have the right to choose its partners, to enter the association, or to leave it, according to its own interests and needs.

- There should be, in principle, three kinds of prices: fixed prices, set and controlled by the center, of basic raw materials, foods and products; limited prices; and free prices, which will emerge from supply-and-demand relations or from an agreement between the supplier and the customer.
- The criterion of enterprises' activity is not the fulfillment of plan targets but the size of their gross income, the use of which will be determined by the enterprises themselves.
- In order to restore completion, even with the high degree of monopolization of domestic production, the entire economy must be gradually confronted with world markets. A transition to convertible currency is a long-range assumption.
- A prerequisite of reform is a change in the level of wholesale prices which must objectivize price relations both among the branches and within them.

- Introduction of levies on basic funds and restoration of the active role of interest rates is to emphasize the role of capital in creating values and to make rational economic calculation possible.
- The level of wages and salaries will depend on the gross income of the enterprise. The state guarantees only the minimum basic wages.
- The complex criterion of the effectiveness of economic management should prevent the growth of productivity of present labor being paralyzed by a decline of the productivity of capital.

This proposal of economic reform formulated first in 1964 called for a new system of the functioning of economy. However, the party leaders, though they agreed formally with the principles of the reform, in practice insisted that they were merely going to make the old system work more perfect. This conflicting interpretation resulted in a slow progress of the reforms because the political leadership was not willing to give up their economic power and tried to preserve as many elements of the old command system as possible.

The principles of the reform proposal were deformed by innumerable compromises in 1965-67. The specialized minis-

tries were not abolished; the associating of enterprises in trusts was obligatory; although directive targets were abolished, they survived in the form of orientation targets which were in fact obligatory; gross income was understood in practice not as a criterion of enterprise management but as a directive target; the relationship between the enterprises and organs of state was not one of equality; enterprises did obtain a number of rights but without any legal guarantees. Branch directorates which had taken over to some extent the job of branch ministries in imposing targets on enterprises in many cases did not change their behavior after the reform was legally introduced. The productive economic units also used their power to tighten their monopoly position. The hierarchical subordination also continued between the branch directorates and the branch ministry which had various instruments available to influence the directorate. One of the leverages was that it appointed, dismissed and evaluated the performance of the general manager.

In 1966, a resolution of the Central Committee was adopted on the so called accelerated introduction of the economic reform which in practice represented a victory for the reformers. The resolution of the Central Committee to accel-

erate the reform was put into legislation by the Order in Council. The Order in Council limited the assignment of output targets to 'unavoidable' cases. Exception from this rule were foreign trade and central investment, where binding targets could be set for enterprises. The reform put the maximization of gross income in the center of the regulation system. This indicator was to be the main incentive in the sense that wage growth and bonuses depended on it. It was also to serve as a guide to decision making and the basis for taxation. The enterprises were not to be assigned targets for the fulfillment of gross income. The authorities regulated its growth and distribution by indirect methods, primarily by taxation.

In determining taxation, the reformers were determined to terminate the old practice of rewarding poorly performing enterprises at the expense of those performing well. They replaced the old progressive taxation with a flat tax of 18 per cent on gross income. The purpose of the taxation was no longer to mitigate income differences and instead was supposed to become an instrument of efficiency. Taxes were to show enterprises to what extent their performance was efficient and to exert pressure on enterprises to increase the efficiency of their operations.

The resolution of the Central Committee made it clear that planning remained the main coordinating mechanism though its role was limited primarily to macroeconomic sphere. It determined the most important macroeconomic proportions, the direction of economic growth, including the distribution of investments between sectors of the economy and important investment projects. It also had to take care of the international division of labor and technical development. Finally, the plan determined the economic regulators and their application. Two kinds of economic regulators were specified in a law: long-term (in substance fiscal) taken preferably from the five-year plan, and short-term (monetary, prices, etc).

Price reform could proceed only slowly due to great shortages and monopolization. The main objective was to let market forces play a role in the formation of prices and consequently in the decision making of enterprises. But the level of consumer prices was to be maintained the same. As a result of the Resolution, the wholesale prices were reconstructed effective January 1, 1967. Profit was added to the production costs in accordance with the two channel price type which meant a percentage of the capital employed (6 percent) and a percentage of the wage bill used (25 percent). A

grouping of price had already been introduced in 1966. It consisted of three categories: fixed, limited, and free.

Further, the Resolution granted enterprises a considerable measure of autonomy from the central organs. The enterprises could determine the product mix, how to produce and where to buy inputs, and they also obtained much greater freedom in determining wages and employment. However, decentralization was backed not by law but merely by the benevolence of those in power. As a result, enterprises obtained their own resources and wanted to start doing business, but they were afraid to act because the authorities might change their mind and punish them later. It was becoming clear to everyone involved that the economic reform could not be achieved without simultaneous political reform.

The second stage of the Czechoslovak economic reform in 1968 went beyond a narrow reform of the economic mechanism. It grew instead into a new concept of socialism combining the market economy, run according to a plan, with political and economic democracy. Two new elements were added to the reform proposal of 1964: the concept of structured socialist ownership; and the concept of self-administration and workers' councils. These concepts were believed to have solved the contradiction between economic efficiency and ideologi-

cal principles of socialism. However, these concepts were never allowed to achieve a concrete form. The invasion of armies of the five Warsaw Pact countries interrupted the reform of the Prague Spring.

In 1969, the new political leadership started to dismantle the reform from 1966-1969 and returned to the old, centralized form of management. Although the economy improved for a while, by the end of 1970's it started declining again. This

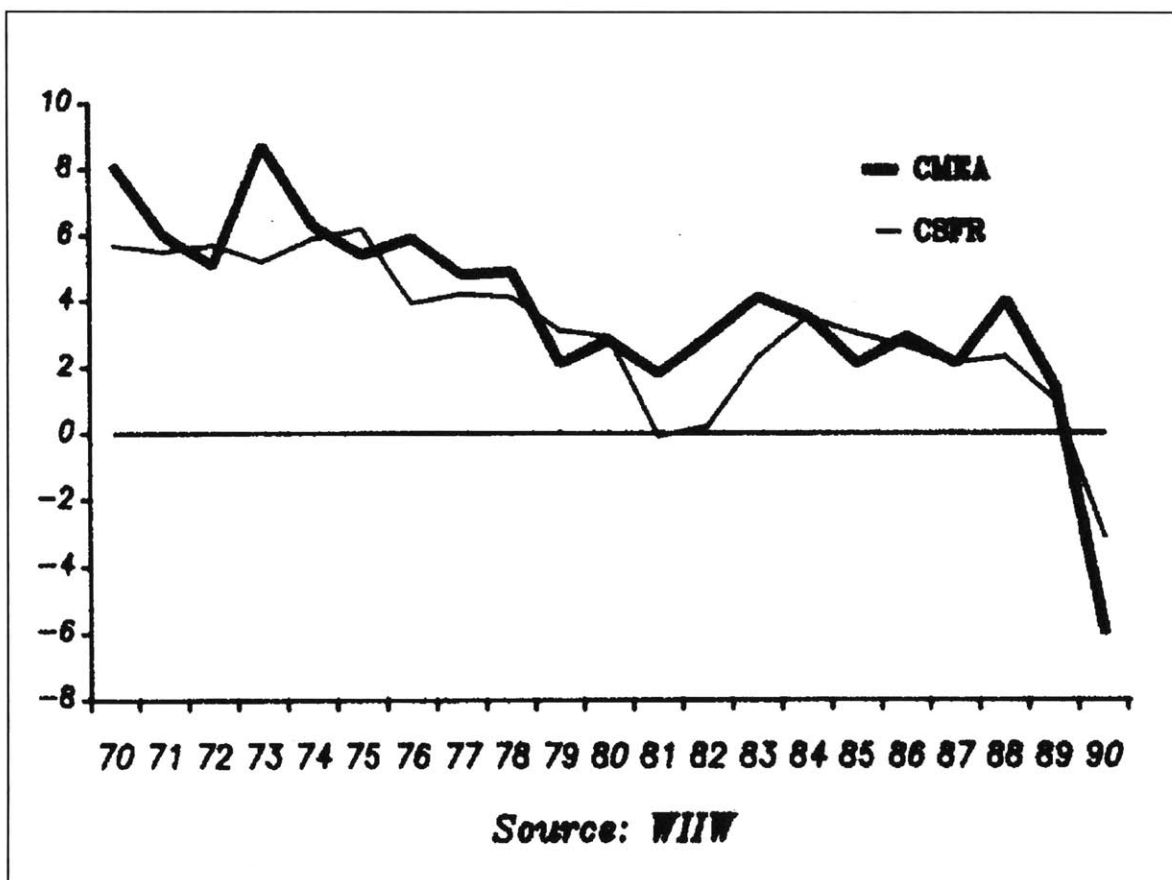


Figure A.3: Performance of Czechoslovak Economy between 1970 and 1990

fact called for a new reform that has been slowly taking place throughout the 1980's. The main push for the reform came from the outside when the Soviet leader, Michael Gorbachev launched his reform. The Czechoslovak leadership promptly followed Gorbachev's initiatives. In 1987, the Central Committee and the government published documents called "Principles for the Restructuring the economic mechanism in the CSSR" and "Concretization of the principles for the restructuring of economic mechanism in the CSSR." The objective of these reforms was the same as before - to put the country on the path to the intensive type of economic growth, help to accelerate the restructuring of the economy, intensify the process of innovations and modernize the industry.

As before, the reform promised to increase autonomy of the enterprises by reducing the number of assigned output targets. It called for improvements in the drafting of state plans, in their handling down to enterprises and in the position of enterprise. Again, the reform called for a diminishing role of physical planning. Financial flows and value instruments were no longer to play a passive role in the sense that they simply adjust to set physical targets and proportions. Further, the decisive criterion for the inclusion of tasks in the state plans and plans of organizations

were to be economic efficiency. On the level of organization, the criterion would be profit. The central planners were supposed to rely more on indirect methods so that profits would result in importance.

The new incentive system was changed against the old in that wage-bill growth was linked to a net indicator, adjusted net output instead of a gross indicator. The rationale for this change was to strengthen the pressure on enterprise to reduce material costs.

Investment decision and financing also underwent some changes in order to deal with the tendency to overinvest and to achieve low return on investment. Two categories for investment in fixed assets were introduced.

The first category comprised centralized investment projects which were included in the national plan. These investment projects which had a claim for preferential treatment had to be approved by the central government. Until 1986, these investment projects were financed from the construction fund which every production economic unit and enterprise had or directly from the state budget in case of unproductive investments, certain important investments in the field of science and technology, and exports. The second investment category, centralized investments required only

the approval of the republics governments. These projects were financed from the enterprise development fund.

The two funds were capitalized differently. The construction fund was assigned to enterprises on basis of estimated costs of investment projects. The development fund was formed on the basis of a normative set by the authorities. Bank credit was also available for both categories of investments. However, provision of bank credit was not considered automatic. Projects promising better returns could be provided with more credit. For projects oriented to modernization of existing capacities, the interest could be lower than average. Differentiation in the interest rate was also used to accelerate the construction work.

However, in spite of all these reform efforts, the correction needed a more radical measures. The interventions of 1980's did not speed up the slow progress in technology. It appears that the central planners relied too heavily on setting incentives at a time when innovations should have resulted from grappling with problems arising in the process of production. The two level prices and giving enterprises more leeway in decision making about drafting plans, wages, incentives and investment were not a sufficiently strong

stimulus in the face of the many factors which discouraged enterprises from innovating.

Also, the putting stress on enterprise self-financing to induce enterprises behave efficiently was in principle correct. However, it could not work under the current conditions - enterprises were assigned targets which they had no right to reject even if they could do something else more efficiently and the tax burden was too high to leave sufficient profit at enterprise disposal. The perceived need to use market forces and to dismantle the high concentration of industry provided ground for the radical change in the 1990's.

The Reform of the 1990's

The economic reform of the 1990 followed immediately after the fall of the Communist regime in Czechoslovakia. The reform went over the radical propositions of the 1968 to a complete restoration of capitalist market economy. In 1990, a radical transition and austerity plan was passed by the Czechoslovak parliament. Preparatory laws and government decrees were laid down during that year. In January 1991, the

full complete set of transition policies came into effect.

The main policy measures were:

- restrictive monetary and fiscal policies (macroeconomic stabilization);
- privatization and restructuring program;
- liberalization of prices combined with limited price controls;
- internal convertibility with a sharp devaluation of the currency and import protection through import surcharges;
- foreign trade was open to all enterprises with the exception of trade in armaments and pharmaceutical products.

However, a new tax law enabling free enterprise was not passed until January 1993.

The Privatization Process

Prior to 1989, Czechoslovakia recognized four principal types of economic enterprises: state enterprises, cooperatives, foreign trade enterprises, and municipal enterprises. Commercial relations were regulated by three different legal regimes. The Civil Code governed the relations between pri-

vate individuals and enterprises. The Economic Code regulated interactions among enterprises. The International Trade Code governed relationships arising in the context of international trade.

After the collapse of the communist regime in 1989, a wholesale reform of the legal framework of economic activity has been accomplished within a period of less than two years. The Economic Code was first amended in April 1990, and subsequently superseded as of January 1992 by the new Commercial Code. In addition, a special Law on State Enterprise which transformed the rules governing the operation of state enterprises was passed in April 1990. Another law, the Law on Private Business of April 18, 1990, abolished the old system of permits, established an individual right to perform private economic activities without any limitation on the number of employees, and set up a system of registration of individual business enterprises.

The following is a list of the more important laws concerning property rights, forms of business organizations, and privatization in Czechoslovakia:

- Act No. 103/1990 Amendments to the Economic Code, Act No. 98/1988, which amended Act No. 109/1964;

- Act No. 104/1990 On Joint Stock Companies;
- Act No. 104/1990 On Private Business;
- Act No. 111/1990 On State Enterprises;
- Act No. 112/1990 On Enterprises with Foreign Capital Participation, amending Act No. 173/1988;
- Act No. 113/1990 On Economic Relations with Foreign Countries, amending Act No. 42/1980;
- Act No. 298/1990 On Regulations of Property Relations of Religious Orders and Congregations and the Archdiocese of Olomouc;
- Act No. 403/1990 Mitigation of Property Related Injustices;
- Act No. 427/1990 About the Transfer of State Property and Some Goods to Other Legal and Physical Persons;
- Act No. 458/1990 Amendment of Act No. 403/1990;
- Act No. 528/1990 The Foreign Exchange Act;
- Act No. 87/1991 On Out-of-Court Rehabilitations
- Act No. 92/1991 On Conditions and terms Governing the Transfer of State Property to Other Persons;
- Act No. 229/1991 On Regulation of Ownership of Land and Other Agricultural Property;
- Act No. 328/1991 On Bankruptcy and Settlement;
- Act No. 455/1991 The Entrepreneurial Act;
- Act No. 513/1991 The Commercial Code;
- Act No. 42/1992 On Regulation of Property Relations in Cooperatives;
- Act No. 248/1992 On Investment Corporation and Investment Fund.

In contrast to Hungary and Poland in which considerable autonomy was conferred on state enterprises earlier, the Czechoslovak state preserved its centralized commanding role over the enterprises until the revolution of 1989. After the Soviet invasion of 1968, reforms of economic activity were stopped and the state reasserted its administrative power over the economic activity.

The communist state enterprise was headed by the managing director. The director could be nominated by the founding organ (usually the sectoral ministry) or elected by the worker's council. But even in the later case, the government retained the right to approve or reject the choice of the council. The ministry also approved the compensation of all employees, including top management, and retained the right to influence current production decisions.

The 1990 Law on State Enterprises changed the legal structure of the state enterprises to adapt them to the new economic environment. Two forms of enterprises were recognized:

- Basic State Enterprise, which is involved in commercial activity. The basic enterprise is run by the managers who are nominated by the founding organ and the Supervisory Council.

- Public Interest Enterprise which is involved in the provision of public-oriented services. These enterprises have no supervisory councils, and their founding agencies are directly involved in the running of the enterprise.

A State Enterprise becomes a legal person acting in its own name, bearing full responsibility for its activities. The activity and operation of the state enterprise can only be limited or interfered with in the manner stipulated by law. State enterprises do not have ownership rights in the objects and property entrusted to them at the time of their foundation; these objects remain the property of the state. The manager who is appointed and may be dismissed by the founding organ, poses power larger than those in a traditional corporation. The manager not only runs the day-to-day operations of the state enterprise, but also, after consulting with the supervisory council, approves accounting statements and distributes available profits.

The Supervisory Council is primarily an advisory body, with no direct powers. It is authorized to review the accounting statements and the distribution of profits, to discuss the major issues concerning the development of the state enterprise and to recommend the dismissal of the man-

ager. The founding organ determines the number of members of the Council, of whom half are appointed by the founding organ and half elected by the employees.

Until December 31, 1990, the founding organ could transform the state enterprise into a joint-stock company transferring to it all property entrusted to the state enterprise. After that date, all transformations of state enterprises into commercial company form are were connected with the privatization process.

All organized business activities other than state enterprises became governed by the Commercial Code. The code recognizes six types of legal entities organized for the purpose of engaging in entrepreneurial activity: individual private entrepreneurship, cooperative activity, general commercial company, limited partnership; limited-liability companies; joint-stock companies. All commercial companies must be listed in the Commercial Register.

Most state enterprises are transformed into a joint-stock company during the privatization. A joint-stock company is a company with limited liability whose shares can be publicly traded. A joint-stock company may issue both registered and bearer shares, both of which are freely transferable. Different classes of stock may also be issued, but preferred

stock can make up no more than one-half of the capital stock. The company can also issue employee stock certificates. These shares, the value of which cannot exceed 5 per cent of basic capitalization, are restricted, and can be transferred only among employees and retired employees of the company. The Code provides for a mandatory employee bonus plan, specifying that the employees must share in the distribution of profits, but no size of the bonus is specified.

The General Meeting of shareholders is the highest organ of the company. It must have a quorum of shareholders with at least 30 per cent of company's capitalization. A joint-stock company is required to have a Board of Directors, at least three members of which must be elected by the General Meeting or the Supervisory Board. The Directors manage the company and act in its name. The joint stock company must also have a Supervisory Board comprised of at least three members. Supervisory Board members are elected by the General Meeting, but in all joint stock companies with more than fifty employees at least one-third of the Supervisory Board must be elected by an assembly of company employees.

The new Commercial Code changed regulations concerning foreign investment. It repealed the old joint venture law which contained a number of restrictive provisions. Under

the Code, foreign persons may engage in business activity on the Czechoslovak territory under the same conditions and to the same extent as Czechoslovak citizens. However, one significant restriction on foreign investment states that when a foreign investor wishes to purchase the assets or shares of a state-owned enterprise the purchase must be incorporated into the privatization plan for the enterprise and approved by the ministry.

The reform of the structure of ownership and of industrial organization was pursued through the privatization process. Rapid privatization of economy was one of the most important components of Czechoslovakia's economic reform program. The Czechoslovak strategy was to change the ownership structure as quickly as possible, leaving most restructuring to the new private owners.

The privatization process had three principal elements: restitution to original owners, a small-scale privatization program and large-scale privatization. The main organs of government involved in regulating the Czechoslovak privatization process were the Czech and Slovak Privatization Ministries, the Federal Finance Ministry, and the Federal and Republics Funds of National Property.

The Czechoslovak large privatization was established in April 1991 through Act No. 92 "On Conditions and terms Governing the Transfer of State Property to Other Persons." The process of large privatization proceeded through decentralization in the proposal of privatization plans. The right to propose a privatization project choosing any of the number of possible methods was given to anyone. Most of these plans (projects) came from managers or prospective buyers. In contrast, the final approval was organized through relatively centralized procedure. Founding ministries played an intermediary role formally submitting all projects proposed to them, along with their own recommendations or comments, to one of the Republics Privatization Ministries or the Federal Finance Ministry in cases when enterprises were founded by federal ministries.

A.1.2. Government Inquiry into Environmental Performance

The emphasis on large-scale investment in heavy industry from the 1950s onwards largely contributed to the increasing seriousness of environmental degradation in Czechoslovakia. The official party line maintained that under socialism peo-

ple and environment were cared for and therefore there was no need for concern. Natural laws as well as organization of society could be transformed for human use.

Between 1948 and 1960, the drive for rapid industrial growth was accompanied by little of attempt to address environmental problems. The slow down of economic growth after 1960 brought also first warning signs of increasing environmental degradation though only of a local character at first.

As a response, the government of the Czech Republic established a National Council for the Environment in 1971. This Council was formed to serve as an advisory, coordinatory and policy developing body of the Government of the Czech Republic in the area of environmental protection. However, along with its publication activity the council also kept recommending to the Government to grant widespread exceptions from environmental laws.

The period from 1970 to 1990 was characterized by attempts for maintaining economic growth while keeping political stability by provision of acceptable standard of living. This policy of maintaining acceptable standard of living for the population was conducted at the expense of delayed capital

investment for modernizing production processes and of over exploitation of natural resources.

The major sources of the deterioration during this time were an excessive and inconsiderate extraction of natural resources, extensive pollution emissions and failure to observe ecological laws. These problems were compounded by inefficiency of the economy, its material intensity, aging technological equipment used in production and production of manufactured goods with little respect for ecological consequences.

Air pollution in Czechoslovakia resulted primarily from industrial activities and reliance on low-quality domestic brown coal as the main source of energy. For example, brown coal accounted for 78.3 percent of the energy used in thermal electricity plants. Because industry was often intermixed with housing, air pollution in residential areas was also high. The area around Most in northwest Bohemia became notorious for heavy smog resulting in poor health of the population. Death and morbidity rates in the region of north Bohemia were among this highest in the country. The Human Rights Group Charter 77 published a statement in 1983 suggesting that pollution in northwest Bohemia has reached cat-

astrophic dimensions and was responsible for an increase in social problems and despair in the region.

Water pollution was also becoming a serious problem in the country suffering from a shortage of water. Lack of clean water was cited as not only affecting human health, but also inhibiting industrial expansion. The situation was exacerbated by the geographical position of Czechoslovakia on top of watersheds with a net outflow of water from the country. Also, industrial enterprises were frequently given exemptions from existing water legislation. It was estimated that some 2,300 exemptions permitting enterprises to release untreated effluents were granted between 1957 and 1970. The water pollution problem was complicated by ineffective operation and inadequate maintenance of water treatment plants.

Because Czechoslovakia pursued a policy of autarchy in food production, heavy application of fertilizers in agriculture was required. This was due to the lack of agriculturally productive land in general, and to soil erosion, strip mining, and diminished agricultural productivity from air pollution in particular. The excessive use of fertilizers further exacerbated the existing water pollution and also lead to contamination of soil. The most serious consequence, however, was contamination of foodstuffs by heavy metals.

Another area of concern for environmentalists was damage done to forests. According to 1983 data, 20-30 percent of Czechoslovak trees were believed to be seriously damaged. Deforestation was most serious in Northern Bohemia due to the heavy air pollution from local sources and from trans-boundary transfers from sources in Germany and Poland.

By the early 1980s, there was increasing public concern in Czechoslovakia about public health and environment. Although full extent of the ecological disruption was not revealed during the early part of the decade, it was admitted by 1986 that at least 30 percent of the population in the Czech Republic and 16 percent in the Slovak Republic suffered constantly as a result of high concentrations of air pollutants.

Policy response to the growing environmental pollution was slow and ineffective. Initially, environmental protection was seen as referring to the conservation of nature and wise use of scarce resources rather than to dealing with industrial pollution. Later, the concept of environmental protection included such areas as health, housing, recreation, and urban planning.

The principle of care for, and improvement of, the environment was incorporated into Article 15 of the Czechoslovak

Constitution from 1960. This Article provided for the state care for the environment and protection of natural heritage. However, the Constitution did not specify basic principles of environmental policy and the need for sustainable development of society.

The general environmental laws were passed fairly early - the State Protection of Nature Act no.40/1956, and the Act On the Health of the Population of 1966. These general laws were supplemented by three special laws. The Air Protection Act (no.35/1967), water (no.138/1973 and no.130/1974), and forests (1977). By the late 1980s, the state administration felt that the previous laws and their ineffective methods of imposing fines needed correction. In 1986, new Acts in both Czech and Slovak Republics were passed regarding stiffer fines for offenses breaking state nature conservancy acts and decrees.

A new orientation in environmental policy stressing pollution prevention rather than restoration and liability was codified in a set of new acts from 1988. These acts, one concerning state enterprises (no. 88), another related to the agricultural cooperative system (no. 90) and the third to the non-agricultural cooperative system (no. 94), each contained specific references to the environment. In future,

every state enterprise was supposed to take into consideration any harmful influences that their individual production units might have on people's health. The fourth Act which placed environmental controls on private enterprises was passed in 1990 (no.105). These laws on enterprises made a significant change in policy orientation by emphasizing the use of less wasteful technology and placing stress on the creation of an effective environmental control system for which management would be directly responsible.

Still, the laws of the 1970s and 1980s tended to be very general and failed to be implemented. In addition, they often were contradicted or overruled by other regulations and goals. The fines imposed on polluters were too low to motivate enterprises to invest in pollution control equipment. Most importantly, the economic plans emphasized rapid industrial production at the detriment of environmental protection. This priority was reflected in the incentive system of the enterprises which provided bonuses almost exclusively for fulfillment or overfulfillment of production targets. The importance placed on completing large scale construction projects in the shortest time possible undermined concern for their environmental impact. Lastly, attention to environmental projects was missing from the five-year plans

which had to allocate investment funds, technology and supplies to the enterprises and communities.

The economic priorities were also reflected in the organizational hierarchy of state administration. The economic ministries enjoyed more influence into the policy making process in a situation when public participation was almost non-existent. Responsibility for environmental protection was fragmented among various ministries distributed on the so called gestor principle. According to this principle, the industrial sector ministry was also responsible for monitoring pollution and protecting environment in areas of its activity. Needless to say, this organizational principle led to a conflict of interest between regulation and production with disastrous consequences for the environment.

In 1980's, environment fell to the competence of the Ministry of Health, Forestry and Water, Ministry of Agriculture and Food, and Ministry of Industry at the federal level. Various ministries at the republics level also participated in administering environmental legislation. In 1983, the State Commission for Scientific and Technological Development and Investment (SKVTRI) was established to provide technical information on technical development to planners and to set standards and norms. Air pollution was monitored by the

State Technical Inspectorate while water pollution was watched by the Hydrometeorological Institute. Local enforcement of environmental standards was in responsibility of National Committees. In 1988, a special unit was formed within the Ministry of Interior to manage all Czech environmental protection.

Despite of the problem of fragmented information concerning the extent of environmental damage and the low priority assigned to environmental problems by the country decision-makers, it was becoming apparent that something had to be done. The obvious cost of pollution, wasteful use of natural resources, and damage to health of population called for a response. Thus Czechoslovakia's sixth five-year plan, 1976-80 was the first to include a chapter dealing with the environment. During 1984-85, the State Commission for Scientific and Technological Development and Investments, the State Planning Commission, and the Czechoslovak Academy of Sciences worked together to produce a long term environmental plan for the period from 1986 to 2000. According to this long range plan, the country needed to invest a total of 100,000 million Kcs on environmental protection by the year 2000. The Government intended to stop the increase in pollution

during 1986-90, and to start improving the quality of the environment during 1990-95.

The state program of environmental investments was designed to eliminate all the major sources of pollution in the country. In the period of 1986-1990, the Czechoslovak government planned to invest 17,600 million Kcs on environmental constructions and supplies. The aim was to remove the main sources of air, water and soil pollution. When the program was approved in 1986, it contained 145 individual construction projects out of which 65 percent was for water protection, 25 percent was for air protection and 10 percent for waste management. These projects mainly covered large water treatment plants, fluid gas desulphurization units, and waste disposal facilities.

However, the state program of environmental investments lagged behind its deadlines. Due to poor preparation and lack of supplies of equipment and material, the environmental projects were falling behind schedule. The report of the State Planning Committee from 1989 found that only 25 percent of the planned work on environmental projects was completed.

With the removal of restrictions on the press and public debate after the fall of communism in Czechoslovakia, new information has been made public concerning the extent and seriousness of the country's environmental problems. Old problems were joined by new ones such as discovery of extensive damage done by Soviet troops on their military bases. The public also learned openly for the first time about problems with heavy metals, radioactive and bacterial contamination of the food and water supply, the extent and consequences of air and water pollution throughout the country, the damage created to the country's forests, and the impact of these problems on human health and life expectancy.

A proliferation of environmental groups and green movements arose with the political liberalization in late 1989 and early 1990. Among the most important of these were the Green Alternative, and the Green Circle which also associated a number of environmental groups from the late communist period such as Brontosaurus, the Ecology Section of the Czechoslovak Biological Society under the Czechoslovak Academy of Sciences, the Czech and Slovak Union of Nature Conservationists, and the Ecological Society. In a typically European way, several of these organizations united to form

the Czechoslovak Green Party in 1989 which in turn joined with the Slovak Green Party in February 1990. However, since the Green Party received only slightly over 3 percent of the vote in June 1990 elections, it did not seat any representatives in the Federal Assembly. The Slovak Green Party was more successful in that elections - six seats in the Slovak National Council were won for the Slovak Green Party.

Many of the other political parties also emphasized environmental concerns. The first democratic government took immediately a number of steps to deal with pressing environmental concerns. Among these steps, new environmental laws were written and state environmental administration reorganized.

The Ministry of the Environment of the Czech Republic was established on December 19, 1989 by Czech National Council Act No. 173/1989 S.B. and founded on January 1, 1990 as the central state administrative body and highest inspection body in environmental matters. A counterpart Slovak Council for the Environment was established in Slovakia and was later renamed the Slovak Ministry of the Environment after the Czech-Slovak split in December 1992. A Federal Committee for the Environment was established in June 1990 to coordinate cooperation between state institutions, legislative

organs, and interest groups. The Committee was to have supra-ministerial position in order to emphasize and transmit the importance of environmental issues into the activity of the all state administration. One of the goals of the creation of the new Ministries was to concentrate the scattered, nonintegral and often contradictory jurisdiction of various central authorities dealing with the environment in a single body. Another goal was to form the state protection of the environment on the new understanding of the complementary relationship between market mechanisms and the State's role in providing environmental protection. This new relationship was described in a recent State Environmental Policy Document (MECR 1995):

Market mechanisms can only function effectively in those instances wherein ownership relations may be defined and/or negative external effects ignored. Ownership relations in some components of the environment, such as protection of the soil, water reservoirs, etc., can be easily defined and preservation in these areas is provided under the protection of ownership. The role of the State in these areas is to develop the respective legal and institutional framework to facilitate such protective arrangements. On the other hand, the State has a primary obligation to protect those components of the environment where ownership relations are difficult to define and/or those cases where external negative effects are produced

which affect the public good. Therefore, State participation in the protection of the environment is essential where the components of the environment represent common goods which cannot be owned and/or where it is impossible to exclude the use of these goods (namely, the air, the climate, significant water courses and ecosystems) and where international commitments must be observed. The State is responsible for determining the optimal functioning of market mechanisms through normative and economic instruments and may also initiate the introduction of new mechanisms (e.g. tradeable emission permits).

The task of state governments is to formulate environmental policies that coordinate progress in individual areas and attain the most effective solutions for the respective problems at hand. In most environmental policy programs, the priority problems have been identified as the endangerment of global biosphere systems (climate change, depletion of the ozone layer, air and water pollution, deforestation), the reduction of biological diversity (the unnatural extinction of species, the degradation or loss of ecosystems and biotopes, the reduction of the genetic fund), the degradation of natural resources (the loss of arable land and reduced soil fertility, the lack of potable water, the exploitation of non-renewable resources) and those areas which represent a direct threat to human health (hazardous physical, chemical and biological factors). Within the framework of the solution of priority problems, state environmental policy programs define objectives in terms priority, content and timeliness and suggest those instruments which are most appropriate for achieving these goals.

The role of the Government in the implementation of its environmental policy was determined to consist of the following responsibilities:

- Amending the existing legal provisions and drafting new legislation so as to establish new normative, economic, informational and institutional instruments for environmental protection.
- Direct channelling of financial flows (the State budget, the State Environment Fund and the National Property Fund).
- Indirect channelling of financial flows (the private sector).
- Guaranteeing international commitments and obligations.

In the first phase of their formation, the Ministries were mainly concerned with the creation of the strongest possible position, based primarily on firm legislation. Between 1990 - 1995, 14 new acts of law, numerous amendments and dozens of other legal provisions were adopted and enacted to establish a system of normative, economic, institutional and informa-

tional instruments to protect the environment in the Czech Republic.

- Act No. 17/1992 S.B. on environment protection, provides the basic notions and principles related to the protection of the environment.
- Obligations relating to EIA are provided in the Act of the Czech National Council No. 244/1992 S.B. regarding environmental impact assessments.
- Act of the Czech National Council No. 282/1992 S.B. regarding the responsibilities of the Czech Environmental Inspection and its jurisdiction in the protection of forest areas, to a large degree unifies the control activities in the sphere of the environment.
- Act of the Czech National Council No. 388/1991 S.B. regarding the State Environment Fund, unifies State funding of environmental protection.
- The protection of air is provided in Act No. 309/1991 S.B. regarding the protection of the air from pollutants (amended by Act No. 211/1994 S.B.), in the follow-up Act No. 389/1991 S.B. regarding obligations for State administration of air protection and provisions for air pollution charges (amended by Act No. 212/1994 S.B.) and in other legal provisions.
- The protection of the Earth's ozone layer is governed by the recent Act No. 86/1995 S.B.
- The protection of water and the provisions related to water management are provided in Act No. 138/1973 S.B. and follow-up provisions.

- The geological and mining spheres are governed by Act No. 44/1988 S.B. on the protection and use of mineral wealth, by Act No. 61/1988 S.B. on mining activities, explosives and the State Mining Administration, and by Act No. 62/1988 S.B. on geological undertakings and the Czech Geological Office.
- Soil protection is governed by Act No. 334/1992 S.B. regarding the protection of the agricultural soil fund.
- Nature protection is governed by Act No. 114/1992 S.B. on nature and landscape protection and the follow-up provisions.
- The protection of the forest and the principles of forest management are provided under Act No. 61/1977 S.B. (amended by Act No. 229/1991 S.B.) on forest management and the State administration of forests.
- The present legal norms regarding waste management proceed from Act No. 238/1991 S.B. on waste management and the follow-up provisions.

The Slovak Republic retained some of the federal laws of the former Czechoslovak Republic and complemented them with their own laws. The major environmental laws adopted by the Government of the Slovak Republic are as follows:

- Act No. 17/1992 S.B. on environmental protection;
- Act of the Slovak National Council No. 134/1992 on state administration of environmental protection;
- Act of the Slovak National Council No. 128/1991 on

landscape protection;

- Act of the Slovak National Council No. 311/1992 on the State Environmental Fund;
- Act No. 218/1992 S.B. on air protection;
- Act of the Slovak National Council No. 238/1993 on water protection;
- Act of the Slovak National Council No. 183/1993 on forest management;
- Act of the Slovak National Council No. 255/1993 on waste management;

A system of economic instruments was primarily based on the use of charges. The system of charges includes charges for the discharge of waste waters into surface waters, charges for releasing harmful substances into the air, charges for waste disposal, charges for the requisition of agricultural land and charges for the withdrawal of ground water. Revenue collected from these charges (with the exception of Rate I charges for waste disposal which are paid to municipalities) is allocated to the State Environment Fund which, in turn, uses this revenue to provide soft-loans and grants to finance environmental improvements for municipalities and small and medium-sized enterprises.

In addition, the system of economic instruments also includes tax relief for products and activities which meet

environmentally-friendly criteria and allocations from the State budget. Tax relief for these environmentally-friendly products and activities includes: reduced VAT taxes, temporary relief from income taxes, relief from real-estate tax, temporary relief from road taxes, differentiation of single emissions.

The implementation of the State environmental policy yielded many positive results. Between 1990 and 1994, those processes and policies which had caused environmental deterioration were discontinued and as a result significant improvements were recorded in the quality of major components of the environment (namely in air and surface water quality). Notwithstanding these accomplishments, certain problems, such as further reduction of air/water pollution, waste management, remediation of previously damaged areas and nature protection, were still eminent and required immediate action by the State. Thus the Ministry of the Environment of the Czech Republic felt compelled to draft a new State Environmental Policy Document which was approved by the Government of the Czech Republic on August 23, 1995. The reasons which support the implementation and enforcement of the new policy document are as follows (MECR 1995):

- The speed and degree to which the transition to a market economy has produced positive results. The process of economic transformation has contributed, by the removal of the centrally controlled economy, to the renewal of market relations, the restructuring of the industrial sector towards production processes which are less demanding on energy and natural resources and improvements in the state of the environment. However, some of the side benefits from the transition process which contributed to improved environmental quality have been exhausted and an urgent necessity has arisen to update existing mechanisms and develop new instruments to continue the positive results attained during the transition process and to address new needs which were impossible to anticipate in the early 1990s.
- The necessity to develop an adequate legal and institutional framework for applying civil law to protect those components of the environment whose character is appropriate for such legal action. The completion of the privatization process creates the basic conditions for the broad implementation of civil law approaches to the protection of the environment.
- The need to increase the efficiency of environmental protection policies and to incorporate economic principles in these policies. The primary objective between 1990 and 1994 was to terminate as quickly as possible those policies which lead to further deterioration of the environment and to immediately introduce policies

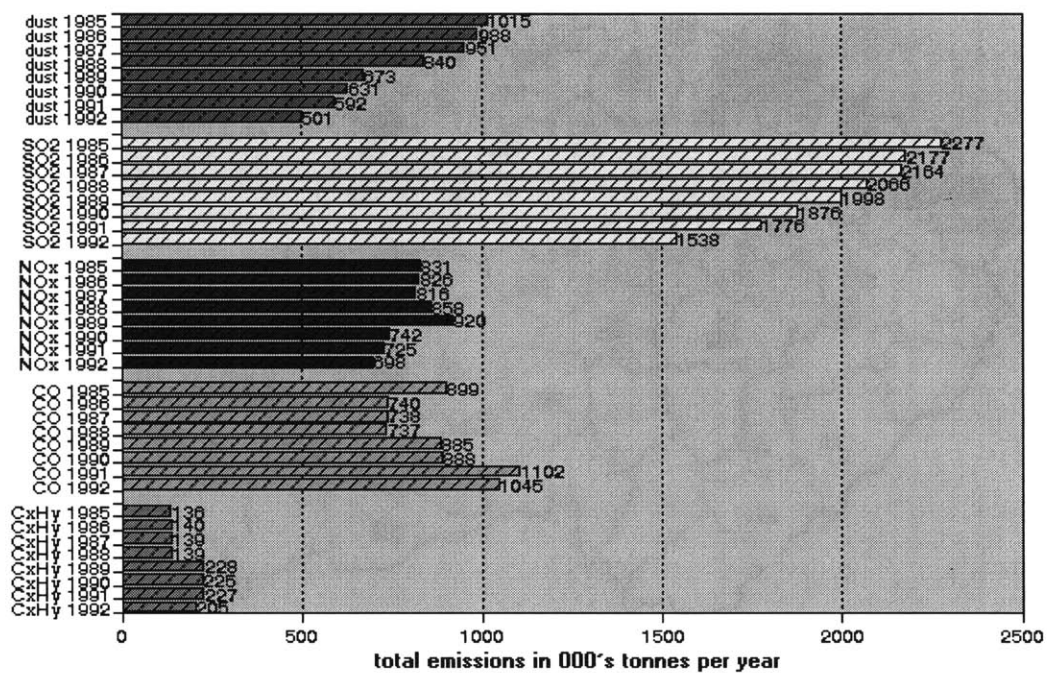
which would lead to improvements. Therefore, policy instruments were implemented based on how quickly they would become effective. However in some instances (such as water protection and waste management), this approach had the unintentional effect of creating policy instruments which were not optimally efficient.

- The necessity to implement economic policies which will induce changes in production and consumption patterns and encourage desirable behavior towards the environment. In conjunction with the environmental policies of the developed countries, emphasis will gradually be shifted from normative to economic and informational instruments which will contribute towards changes in production and consumption patterns.
- The necessity to inform the private and financial sectors of current and future environmental policies so as to create a stable investment climate. Information relating to the environmental intents and priorities of the State is of fundamental importance to domestic and foreign investors, entrepreneurs and financiers.
- The need to support entrepreneurial activities in the environmental protection area and the introduction of environmentally friendly technologies. In the developed countries, the development and trade of equipment, technologies and services for environmental protection has surged over the last decade. It has

been estimated that, on a world scale, the market for such equipment and technologies (especially air and water protection and waste management) will reach the value of approximately USD 250 billion in 1995.

- To facilitate the Czech Republic's accession to international organizations and harmonize the CR's legal system with developed countries. Environmental problems are increasingly becoming central issues for the international community and they frequently receive priority on the agendas of international organizations both within and outside of the UN system. This trend is reflected in the activities of international bodies such as the UNEP and the UNCSD. Practically all developed countries have formulated their environmental policy in the form of a government policy document as evidenced by the European Union's ongoing formulation of environmental action programs (which has completed its fifth program). The evaluation of a state's environmental policy, legal norms and environmental standards is a critical element for consideration in the admission process to international organizations (especially with regard to the admission procedures of the OECD and the European Union).
- To comply and respond to new developments and recommendations stemming from important international activities and events. The Czech Republic supports both global and regional commitments made at numerous international environmental conferences and is

actively involved in offering ongoing support and follow-up to these commitments. The most important of these conferences for the CR were the UN Conference held in 1992 in Rio de Janeiro, the 1993 ministerial conference "Environment for Europe" held in Lucerne, the 1994 ministerial conference "Environment and Health for Europe" held in Helsinki and the 1995 ministerial conference "Sustainable Production and Consumption" held in Oslo. In addition, an important contribution made by the Czech Republic to this process was the sponsorship of the 1991 ministerial conference, held in Dobris and the 1995 symposium "Economic Instruments for Sustainable Development" held in Pruhonice near Prague.



Source: ČHMÚ

**Figure A.4: Total Emissions of the Main Air-Pollutants in the CR
between 1985 and 1992**

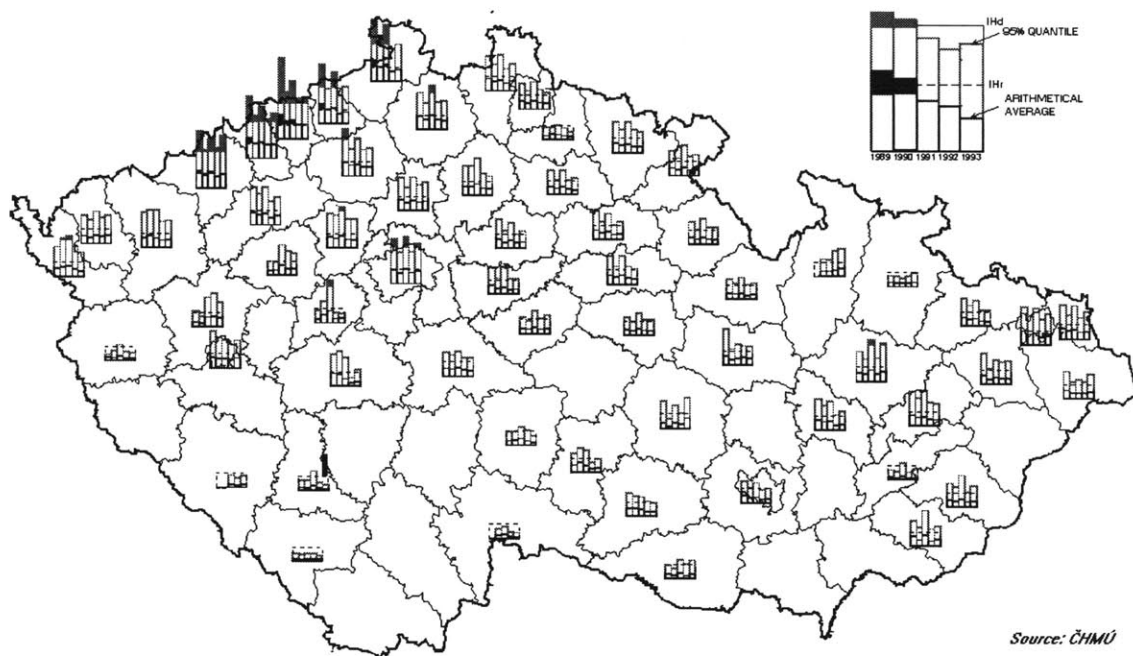


Figure A.5: Concentrations of SO₂ in the CR by District 1989-1993

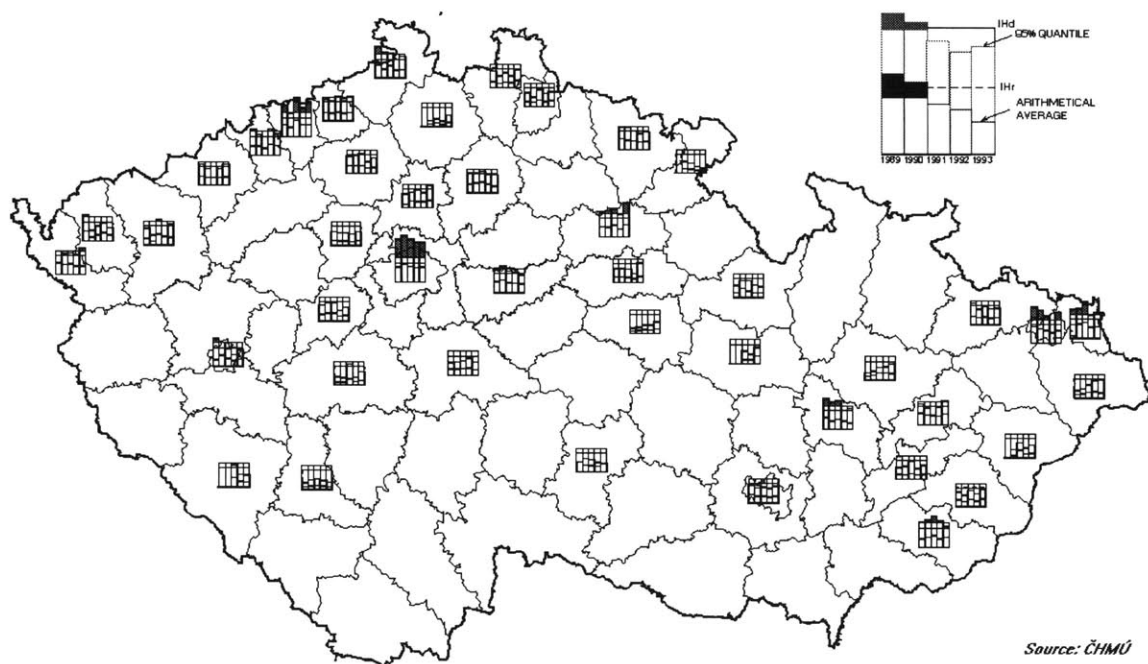


Figure A.6: Concentrations of NO_x in the CR by District 1989-1993

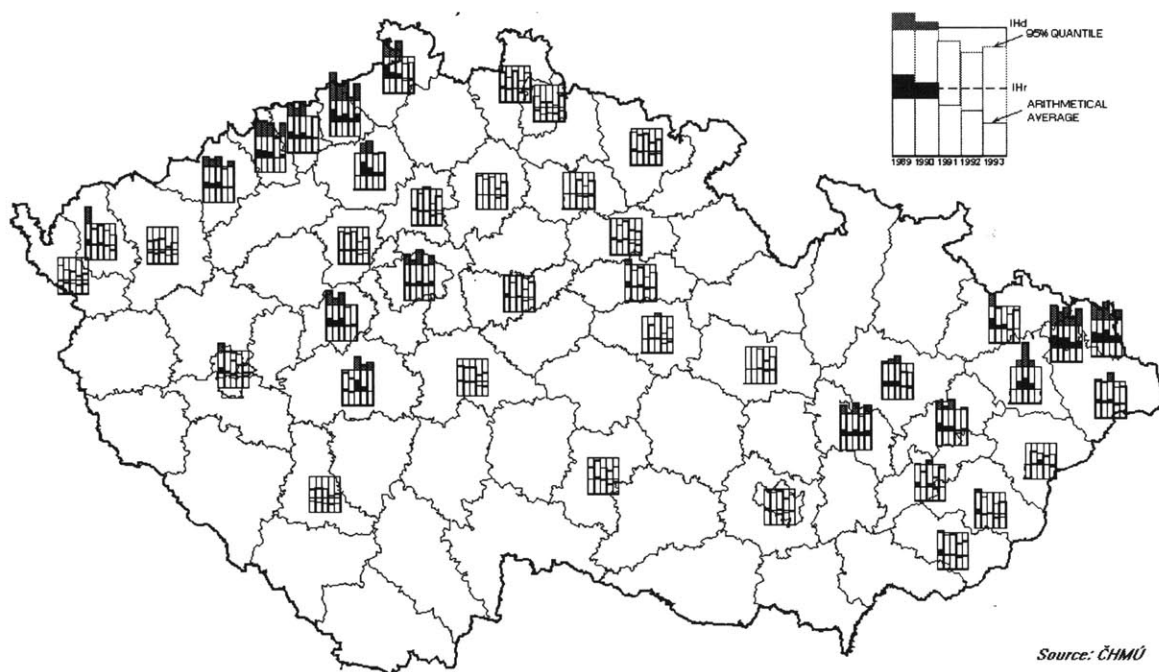
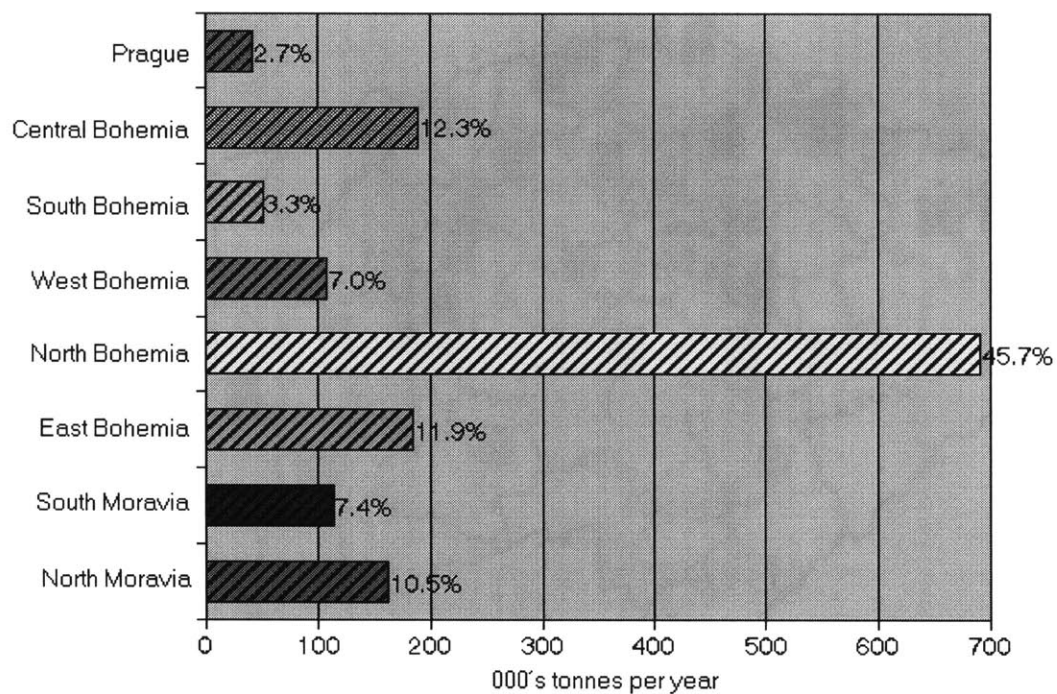


Figure A.7: Concentrations of Particulates in the CR by District 1989-1993



Source: ČIŽP

Figure A.8: SO₂ Emissions in the CR by Region (REZZO 1 - 4)

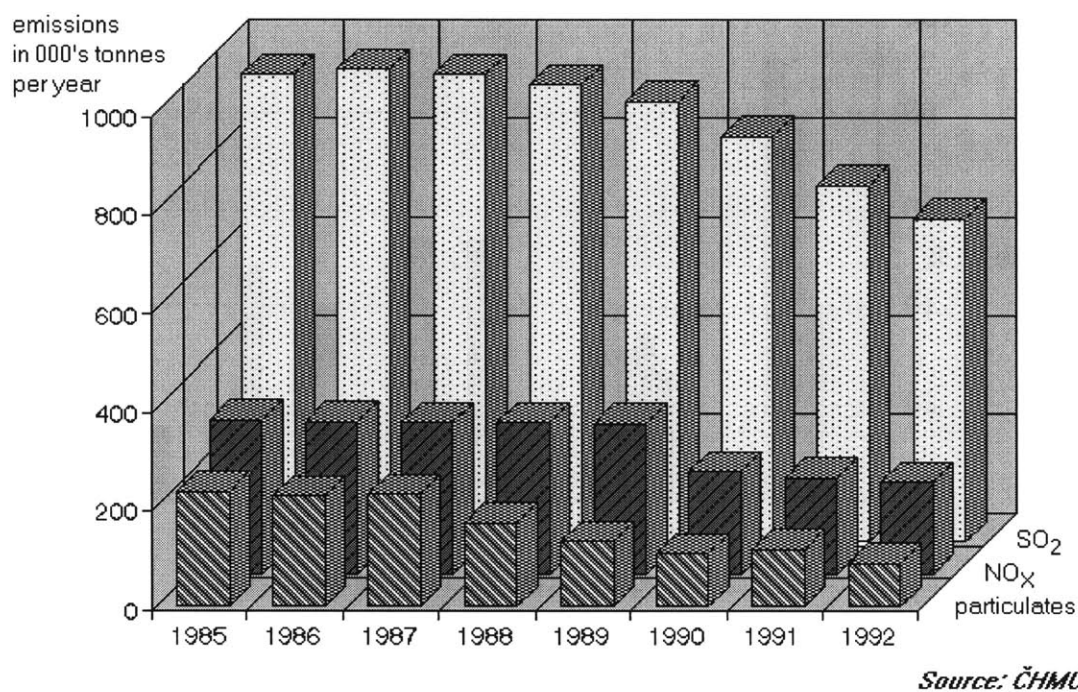


Figure A.9: Development of Annual Main Pollutant Emissions in North Bohemia between 1986 and 1992

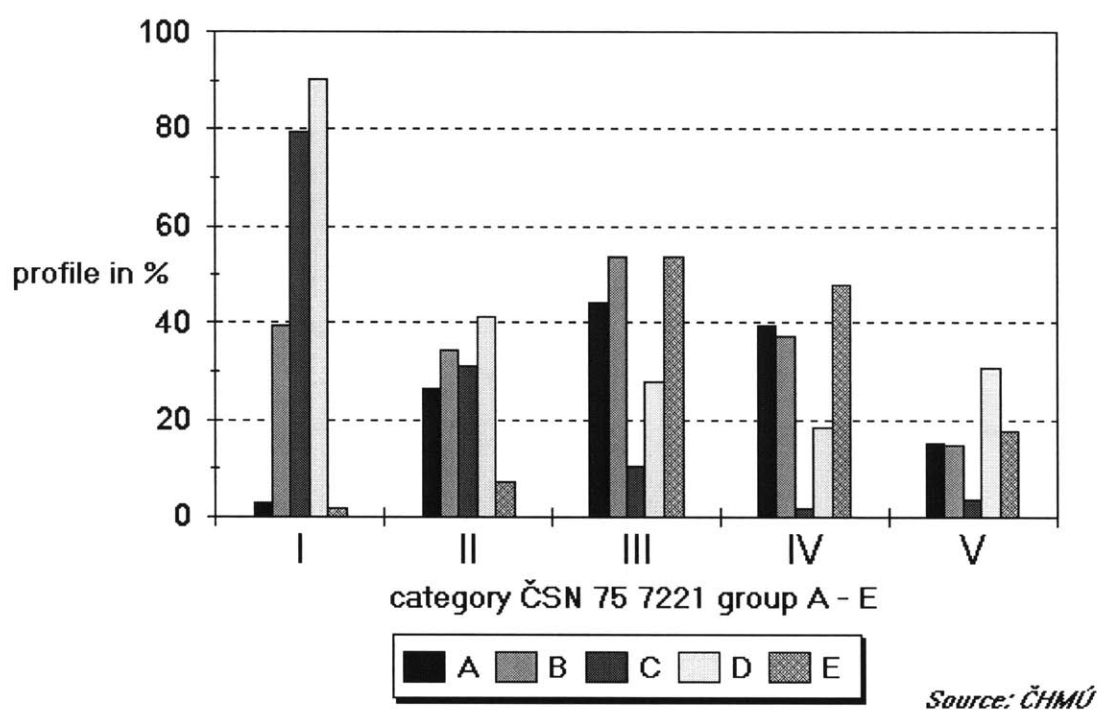


Figure A.10: Quality of Water in the Rivers of the CR in 1993
Classification According to CSN 76 7221

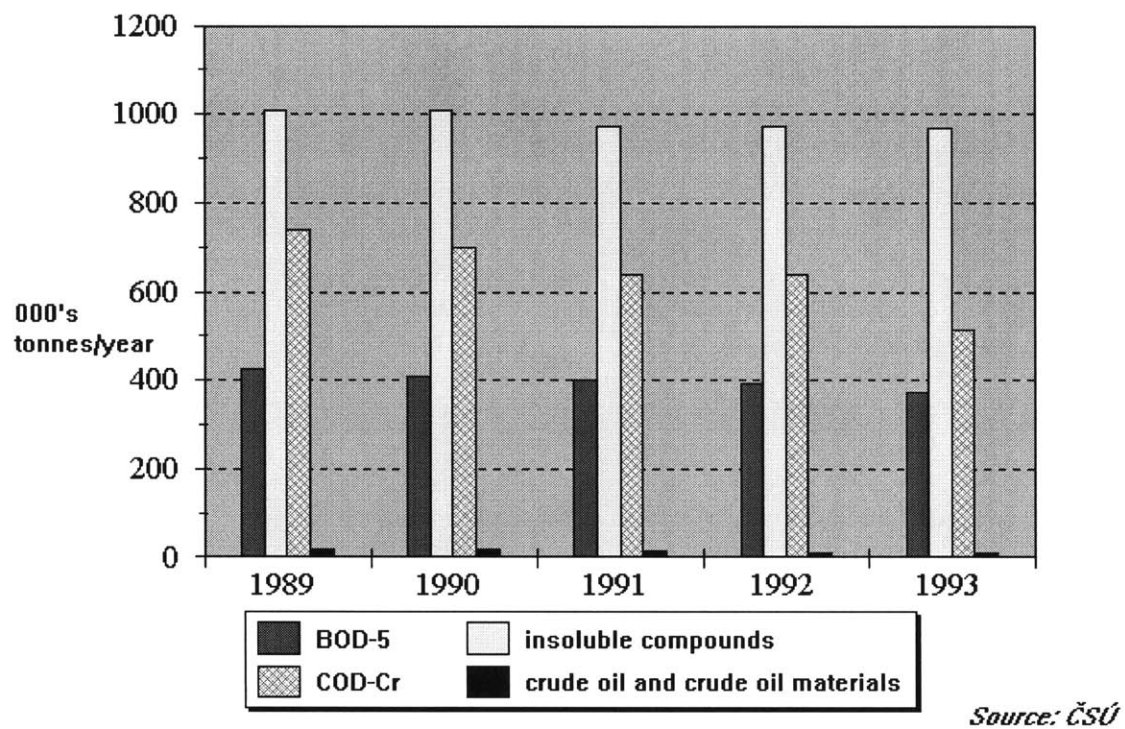


Figure A.11: Water Pollution Produced in the CR between 1989 and 1993

A.2. The Pulp Production Modernization Case



Figure A.12: SEPAP Plant in Steti

The pulp production, located next to the town of Steti, Northern Bohemia, grew out of an old cardboard producing factory. The production facilities are about 50 kilometers from Prague along the bank of the Elbe River. The site occupies an area of 132 hectares and consists of 252 buildings. The covered area is 277,996 square meters, with a total floor area of approximately 445,000 square meters.

The pulp in Steti is produced by SEPAP (the North Bohemian Paper Works) enterprise, the largest integrated paper mill

in the Czech Republic. SEPAP is the only producer of kraft pulp and the largest paper manufacturer in the Czech Republic. The work force of SEPAP Steti totals approximately 2,400 full-time staff working 52 weeks per year on a three shift, eight hour per day basis.

A kraft batch cooking started in Steti at the end of 1950's. Bisulphite cooking was put in operation in 1963 (both closed down and demolished between 1991-2). Along with pulp production, paper manufacturing proceeded as well. Three paper machines were added between 1954-1957 to make test liner, bleached wrapping paper, and unbleached wrapping paper. Another paper machine, producing newsprint, was constructed in 1963. A paper sacks plant started production in 1966.

The second stage of SEPAP complex modernization took place between 1973 and 1975. The enterprise was enhanced of a new Kamyr continuous pulp plant, pulp bleaching plant, recovery boiler (closed down and demolished), water treatment plant, and the fifth paper machine producing sack paper.

The third stage of the enterprise modernization started in 1985. At that time, SEPAP was one of the largest discharges of AOX and COD to the Elbe River. For example, the AOX-loading from SEPAP was higher than that from the eight largest

chemical and pharmaceutical plants and paper mills that were monitored in the Elbe River basin. As a response to this unfavorable situation, a long term plan was designed for capacity increase and a step-by-step pulp and bleaching plants modernization from which the main air and water pollution load was coming.

The Kamyr pulp production process basically consists of the "cooking" of wood chips at 170 degrees Celsius and 12 bar(a) with "white liquor" (a solution of sodium hydroxide and sodium sulphite) in a continuous reactor in order to separate the cellulose fibers in the wood from the unwanted lignin. The products of the reaction are washed with water in a three stage process to produce washed pulp and "black liquor", which is treated in the recovery section. Part of the pulp is then bleached in the pulp bleaching plant for use in production of white paper. Because lignin removed by bleaching cannot be treated in the recovery section, bleaching of Kamyr pulp (kappa number of 40-45) imposes a great demand on the waste water treatment plant. Also, it requires high consumption of bleaching chemicals. Among them, elemental chlorine and sodium hypochlorite are highly harmful substances when discharged into water but difficult to remove

in a biological waste treatment plant (SEPAP is equipped with only the secondary treatment).

Further, transportation and storage of gas-chlorine used in bleaching processes poses a significant health and safety risk. Gas-chlorine is highly poisonous gas which, if accidentally released, could be fatal not only to workers in the plant, but also to the population of the town of Steti. Gas-chlorine is transported in railway cars from a chemical plant about 40 km distant and hard piped from the rail car directly to the appropriate points in production processes. Emergency plans for evacuation of the town were prepared in case of accident.

Thus the main goals of the modernization program were reduction of the load of pollutants released from the plants and elimination of chlorine from production processes. Figure A.13: below shows actions towards environmental protection in SEPAP Steti.

During 1991, the obsolete and environmentally non-compatible NA-bisulphite cooking plant and conventional batch cooking plant were taken out of operation. A new washing and screening plant for bleached kraft was installed. At the same time, the bleaching plant modernization started by replacing the first two bleaching stages and introducing

• shutting the Na-Bisulphite cooking	1991-1992
• shutting the old kraft batch cooking	1991-1992
• new washing and screening plant	1991
• new kraft cooking plant (Super Batch)	1993
• first phase of bleach plant modernization	1991
• reconstruction of the bleaching chemical plant	1994
• production of ECF-bleached pulp	1994
• new bleaching plant, TCF-bleaching	1995
• odorous gas handling system	1993

Figure A.13: Actions Toward Environmental Protection in SEPAP

oxygen and peroxide into the alkaline extraction process. This step reduced demand on use of elementary chlorine by 50%.

The initial contracts for modernization were concluded before the political change in 1989 started. At that time, SEPAP was limited by the constraints of the old centrally planned system that did not allow it to engage in direct trade with western countries. All trade had to be handled through state international trade organizations. For this reason, SEPAP found it very difficult to obtain resources to purchase equipment abroad and to negotiate with the suppliers. The first supplies of machinery were arranged as long term leases with option to purchase the equipment at the end of the leasing period. The leasing continued even after the

economic change in 1989 primarily because it was difficult to obtain long term loans from domestic banks. However, the banks were willing to provide guarantees for the leases.

By the time the initial steps in the modernization program were implemented, the socio-economic context shifted outside the enterprise. The former Czechoslovakia launched on the transition process. New laws were written, economic situation changed, and political processes turned turbulent. Environmental issues became politicized suddenly occupying top of government priority list.

As a result of the heightened public awareness, the SEPAP riding on the new wave of interest in environmental issues was able to obtain state grants for its environmental projects. Between 1990-1992, the State Environmental Fund and the Special Government Program for Cleaning Air Pollution in priority regions of the country allocated grants to SEPAP. The former granted 47.7 million KC for odorous gas handling system and 300 million KC for water treatment plant. The later allocated 15 million KC for bleach plant modernization.

But, the heightened interest in environmental issues brought about by political liberalization also turned public eye on the SEPAP plants. The local community found its voice

to speak up against local environmental issues caused by SEPAP. They were particularly concerned about dust, risk of transporting gas- chlorine, and foul odors escaping from the plant and the sludge field (hydrogen sulphite, mercaptan) that invaded their community's air. After receiving complaints from the surrounding community, the State Environmental Inspection ordered SEPAP to control the odors escaping from the plant. The project to control odors received high priority and was quickly implemented at the cost of 250 million KC. But some managers saw this project as an end-of pipe solution which burdened the firm financially while bringing little profit back.

Following the lesson with the project for controlling foul odors, the management was determined to pursue environmental improvements in parallel with production increases through technological modernization. But further progress of modernization depended on how quickly the firm could pay off the 1.2 billion KC on loans from the previous modernization projects and secure new financing. It was also determined by the physical design of the plants and machinery that allowed some solutions while prevented others.

A particularly burdensome heritage of the past planning in the way of modernization was a reconstruction of the news-

print machine planned and contracted out shortly before the political change. The machine, reconstructed at the expense of 2 billion KC, was to supply guaranteed home market of official party newspaper publishers. However, when the machine was being reconstructed in 1991 and supplies of paper were discontinued for four months, foreign exporters quickly seized their opportunity to sign long term supply contracts with domestic customers. When SEPAP put the reconstructed machine back in operation, the former monopolist producer could only sell enough newsprint to use 50% of its capacity. Further, the new Czechoslovak Government was not able to provide financing for the reconstruction ordered by the old administration. The SEPAP had to pay all the contracts from its own pocket.

The SEPAP went into privatization in the first wave of coupon privatization in 1992 and majority of its shares were picked up in the first round of bidding by the four investment funds. On July 1, 1992, SEPAP introduced organizational changes which incorporated its five divisions as subsidiaries. The SEPAP Holding controlled SEPAP Steti, Bela pod Bezdem, Ceska Kamenice, Jablonec nad Nisou and Zatec. Following the reorganization, each subsidiary operated as an independent legal and economic unit. SEPAP Steti, the larg-

est subsidiary in the group, was 77.3% owned by the SEPAP Holding. These shares were not publicly traded. The remaining 22.7% of the company was held by Technopol, a Slovak foreign trade firm, which agreed to swap Steti's debt for equity in the firm. Shares issued to Technopol were publicly traded.

Instead of waiting until early 1993 when shares were to be allocated in exchange for investment points, Mr. Sabatka, SEPAP's CEO, obtained approval from the National Property Fund to appoint the heads of the investment funds to SEPAP's board of directors. Consequently, the first quasi-shareholders meeting could take place as early as in August 1992. Thus the shareholders were allowed to look at SEPAP's deals from the outset as well as review strategic decisions and question what the management did. Sabatka felt it was important to establish a relationship with the major shareowners straightway and to have a decision-making body in place to negotiate with potential investors and joint venture partners.

In order to free SEPAP Steti of the burden of the newspaper production and the associated financial obligations, a subsidiary of SEPAP Steti, ROTO a.s. was formed as a joint venture with Austrian paper company Leykam Murztaler just

two months after the first official session of the board of directors in October 1992. Under the agreement, Leykam would provide technological know-how and sales and marketing expertise. The SEPAP's directors hoped that the venture would help SEPAP reach its newsprint capacity of 100,000 tons per year.

To support its restructuring and privatization program, SEPAP received technical assistance from the European Community within the PHARE program. The company devised strategy to focus its core business on production of kraft pulp, sack paper and sacks, lineboard, and newsprint and to make its operations more efficient. A key rationalization measure devised was reduction in personnel, streamlining the organizational structure of the company and selling off the four subsidiaries that were not in its core business.

In line with its overall restructuring and recapitalization effort, the company started to strengthen management in 1994. In this context, two full-time top western managers were recruited. Mr. Rolf Norman, Vice President, Marketing and Production (Swedish) has over 25 years of managerial experience in pulp and paper. Mr. Mel Racinsky, Vice President, Finance (Canada) has 19 years of banking experience with the Royal Bank of Canada. These two managers joined Mr.

Tomas Sabatka, the General Manager, who has over 20 years experience. He progressed from a trainee in Steti to his current position.






The company also hoped to find a strategic joint venture partner to invest money and transfer technology. However, a partner was difficult to come by when the company was in debt and turning little profit. Western competitors seemed more interested in exporting from their domestic markets than investing in a local producer. The Scandinavian paper mills could not lay off their own workers for political reasons, even when they faced production overcapacity. There was production oversupply in the market and prices were falling in Europe.

Throughout the company reorganization and in spite of financially difficult situation, SEPAP continued investing in its modernization project (Figure A.14:Figure A.15:Figure A.16:Figure A.17:). In 1991, it started building a new kraft cooking plant (SuperBatch) supplied by Sunds Defibrator. SuperBatch cooking is a modern displacement cooking method capable of extending the cooking to very low kappa numbers. Kappa number 12 was the design basis for SEPAP's plant. The new plant would increase production capacity to 150,000 t/year of pulp while facilitate a significant reduction of the

DEVELOPMENT OF THE BLEACHED PULP PRODUCTION

PHASE A: conventional arrangement

LEGEND

-  waste water from the bleaching stage can be introduced into recovery system
-  waste water from the bleaching stage cannot be introduced into recovery system
-  waste water from the bleaching stage is not environmentally harmful
-  waste water from the bleaching stage is medium harmful
-  waste water from the bleaching stage is strongly harmful



Note: Situation till 1993
Very high waste production

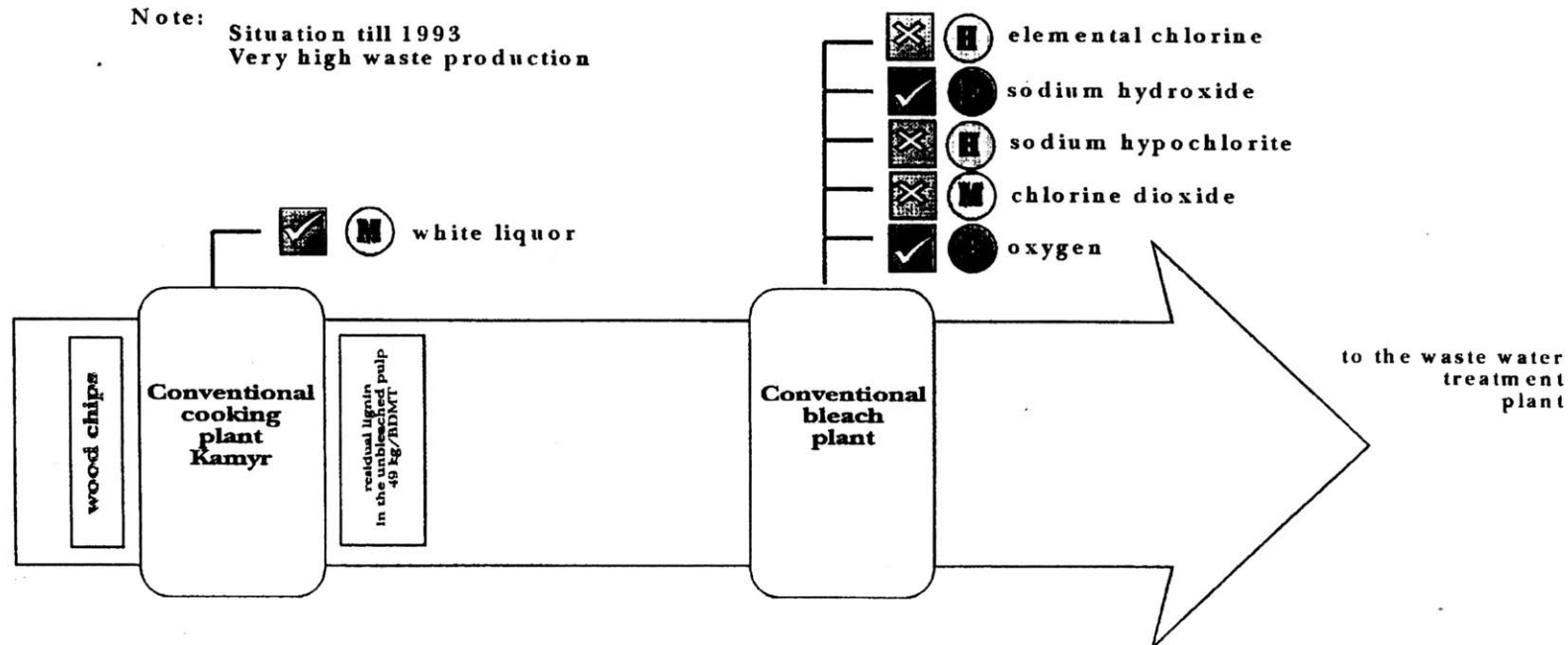


Figure A.14: Production Process Phase A

DEVELOPMENT OF THE BLEACHED PULP PRODUCTION

PHASE B: SuperBatch cooking system



LEGEND

- waste water from the bleaching stage can be introduced into recovery system
- waste water from the bleaching stage cannot be introduced into recovery system
- waste water from the bleaching stage is not environmentally harmful
- waste water from the bleaching stage is medium harmful
- waste water from the bleaching stage is strongly harmful

Note: Existing situation

SuperBatch system produce one half of the residual lignin by comparison with PHASE A.
Waste production is reduced in accordance with this fact.

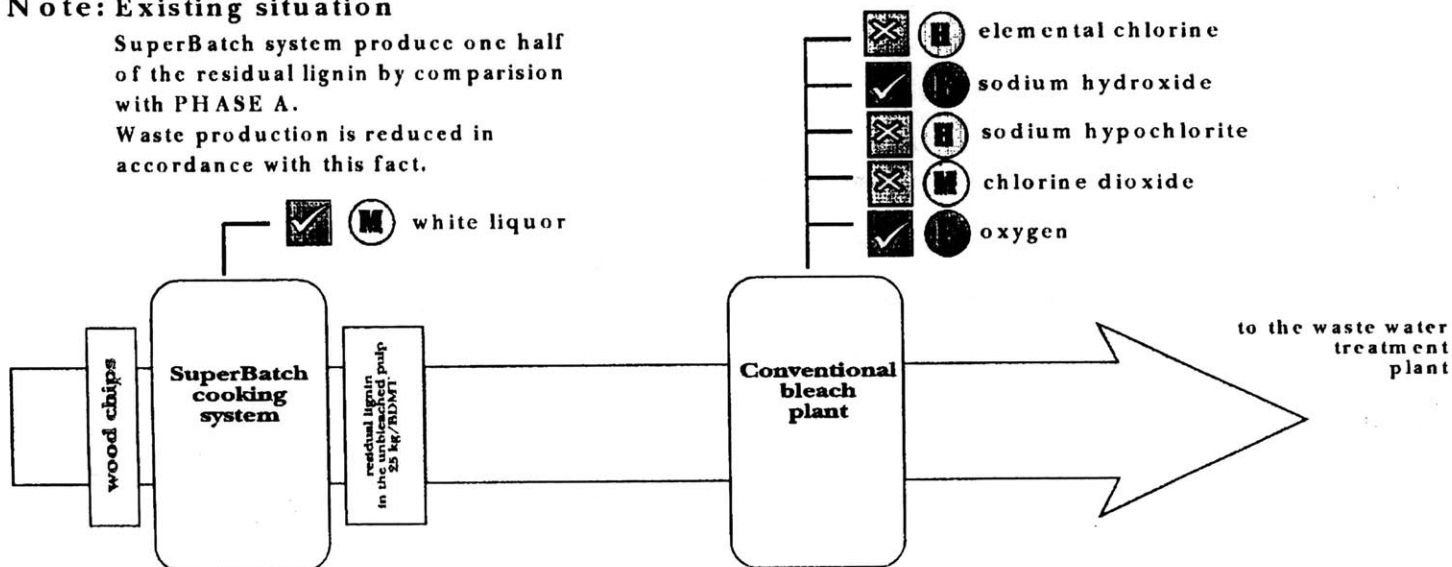





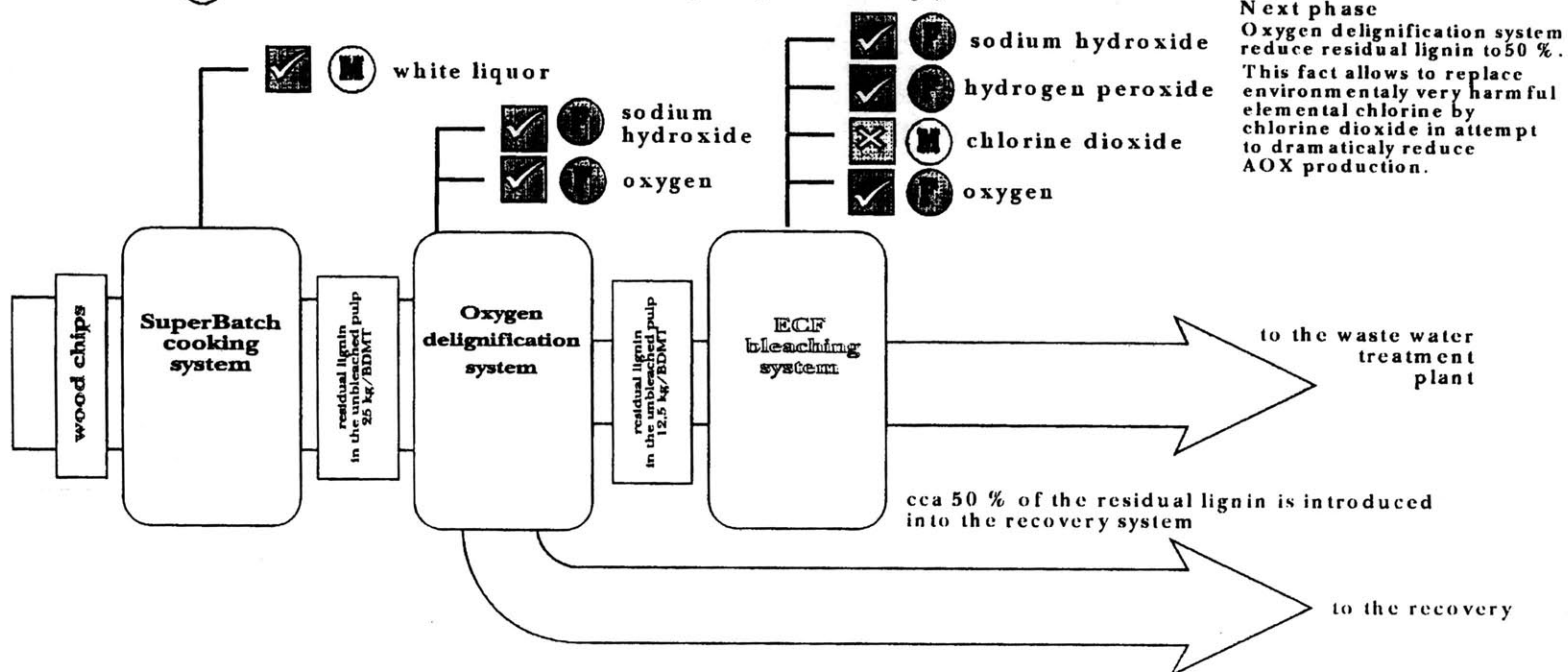


Figure A.15: Production Process Phase B

DEVELOPMENT OF THE BLEACHED PULP PRODUCTION PHASE C: ECF pulp production

LEGEND

-  waste water from the bleaching stage can be introduced into recovery system
-  waste water from the bleaching stage cannot be introduced into recovery system
-  waste water from the bleaching stage is not environmentally harmful
-  waste water from the bleaching stage is medium harmful
-  waste water from the bleaching stage is strongly harmful



Note:
Next phase
Oxygen delignification system
reduce residual lignin to 50 % .
This fact allows to replace
environmentally very harmful
elemental chlorine by
chlorine dioxide in attempt
to dramatically reduce
AOX production.

Figure A.16: Production Process Phase C

DEVELOPMENT OF THE BLEACHED PULP PRODUCTION

PHASE D: TCF pulp production

LEGEND

- ☒ waste water from the bleaching stage can be introduced into recovery system
- ☐ waste water from the bleaching stage cannot be introduced into recovery system
- ☒ waste water from the bleaching stage is not environmentally harmful
- ☒ waste water from the bleaching stage is medium harmful
- ☒ waste water from the bleaching stage is strongly harmful



Note:

Target phase

No chlorine or chlorine compounds are used.
AOX production is negligible.
Very good condition for the future possible closed bleach plant waste water circuit

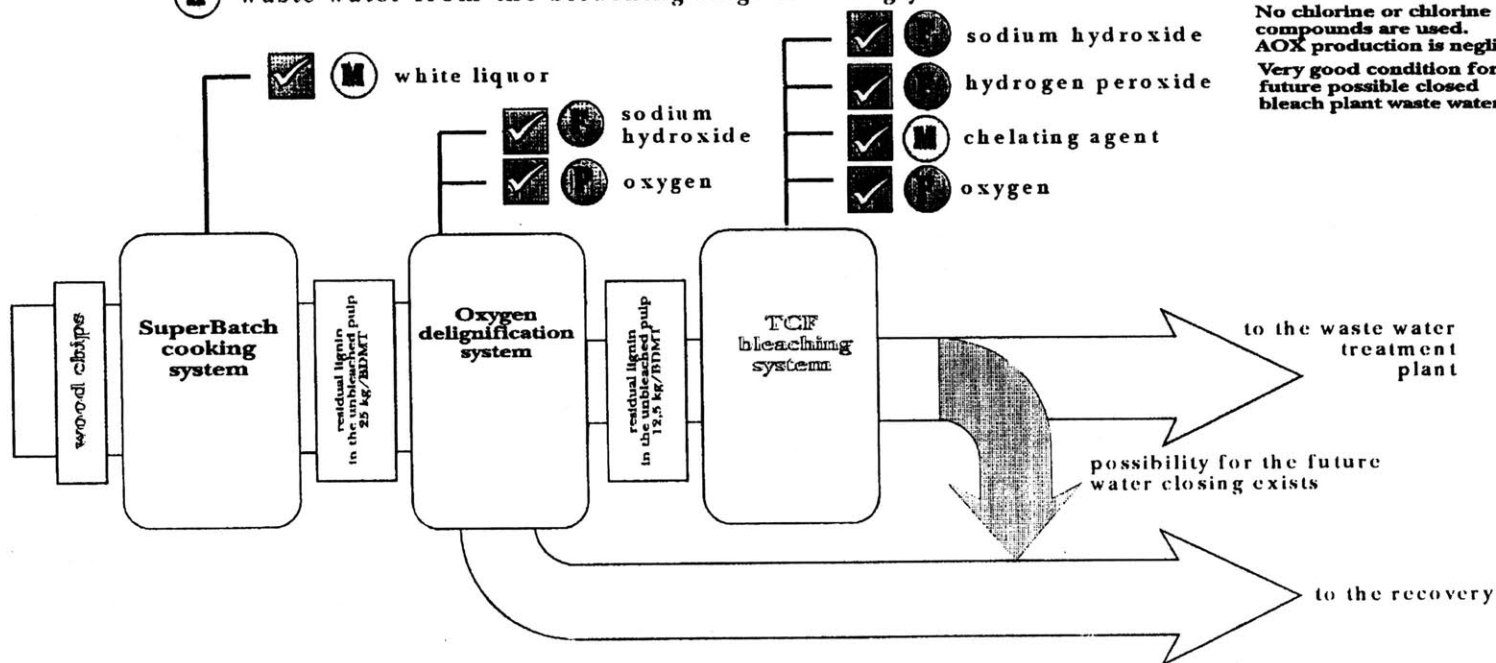


Figure A.17: Production Process Phase D

bleaching chemical consumption followed by less chlorinated organic compounds discharged from bleaching. The SuperBatch plant was put in operation in March 1993.

The next step in the modernization process anticipated construction of Oxygen Delignification plant, and completion of bleaching plant modernization. This step would enable SEPAP to eliminate the use of elementary chlorine from its pulping operations and transfer to elementary chlorine free (ECF) production of paper.

Oxygen delignification was developed to be the most cost effective tool to decrease pollution associated with chemical pulp bleaching. Because oxygen delignification would make it possible to reach very low kappa number prior to bleaching, the bleaching process may substitute less effective but environmentally sound oxygen, hydrogen peroxide and/or ozone for more effective but environmentally harmful chlorine gas. Also, roughly 40-50% of the lignin remaining after the cooking process is removed in the oxygen stage. By counter current washing, the dissolved lignin is brought back to the recovery boiler. Consequently, the amount of organic materials discharged from the subsequent bleaching process can be decreased by the same extent. Thus the consumption of chlorine chemicals and discharge of chlorinated

organic substances would be decreased by oxygen delignification. The environmental features of introducing this technology are as follows:

- 60 percent reduction in COD;
- 70 percent reduction in color;
- 40-80 percent reduction in AOX;

The completion of the project required further 350 million crowns for oxygen delignification and 400 million crowns for the peroxide stage. SEPAP's own resources were drained out by the previous capital investments. By 1994, SEPAP had invested 790 million for capital expenditures from its own resources. Washing line, cooking plant, and one part of bleaching line were finished and on stream. Chlorine dioxide plant was being upgraded and expected to start up in August 1994 so that production of elementary chlorine free (ECF) pulp could begin. To finalize the project and to gain maximal environmental benefits, two hydrogen peroxide stages in the bleaching plant and the oxygen delignification plant had to be built. This last step would enable SEPAP to produce totally chlorine free paper (TCF).

In 1994, financing for the last step of modernization was unavailable from domestic sources. Grant money no longer went to industrial enterprises; only municipalities were eligible. Domestic banks provided only short term loans with a high interest and no grace period. Also, the amount of loan exceeded available resources of domestic banks. But even foreign financing was difficult to obtain because the Czech government was refusing to issue sovereign guarantees commonly required by foreign banks. Foreign commercial banks were reluctant to finance a 100% Czech company in such a difficult industry.

Under normal circumstances, companies in pulp and paper business accumulate substantial cash reserves during upturn which they use in downturn either for covering their losses or for investing into new technology in order to be prepared for the next upturn. However, the SEPAP entered the downturn drained by the former central planning system of its financial reserves.

Finally, the SEPAP contacted the EBRD in London to provide the loan of 58.89 million ECU which was signed on July 25, 1995. The loan proved important not only to the SEPAP, but also to the EBRD for whom it was the largest private sector

loan ever made in the Czech Republic. The loan had the following objectives:

- to improve environment and increase competitiveness by investing in state of the art technology for totally chlorine free pulp production;
- to increase capacity of pulp and paper production;
- to modernize production facilities;
- to improve quality of paper production;
- to encourage commercial bank participation in a purely Czech project through syndication.

The loan was made for maximum of 7.5 years with one year grace period.

Shortly before the loan with the EBRD was signed (on July 20, 1995), AssiDoman, the Swedish conglomerate and one of the world's top ten paper manufacturers, acquired 22.7% stake in SEPAP Steti for undisclosed amount. This stake was formerly held by Technopol Bratislava. AssiDoman also pledged to invest between 1 and 2 billion crowns in the SEPAP plant by the end of the year. It also signed undisclosed agreement on technological cooperation and transfer of know-how.

On August 31, 1995, SEPAP Holding merged with SEPAP Steti as planned before. SEPAP took over the property and payables

of Sepap Steti. AssiDoman also increased its stake over the summer to 34% as pledged.

Consequent to the loan, environmental developments at Steti will be closely monitored by the EBRD whose requirements for environmental monitoring include:

- submission to the Bank of the detailed work plan for proposed soil and ground water investigation, for review and proposal;
- presentation to the Bank of the final report on soil and ground water investigation, and reporting on related consultations with the authorities;
- annual reporting to the Bank on environmental issues associated with the plant, and notification in case of emergencies with significant environmental impact or effect on worker's health and safety;
- annual updates on any use of bleaching chemicals;
- reporting to the Bank on public interaction.

Throughout the restructuring and modernization process, SEPAP actively promoted public information by means of regular publication of environmental results and discussions of environmental issues and technical updates in the local newspaper (SITO). SEPAP's public relations manager attends all town of Steti meetings in his capacity as a town councillor. Financial transparency and accountability was increased

by inviting a reputable international auditor, Arthur Andersen Consulting, to review company's accounts and financial results and by making them publicly available in the company's annual report.

Securing wood supplies, the main production input, also represents a significant area of interaction with the outside of the company. The supply of sustainably grown and harvested wood is critical not only to meeting the policy requirements of the EBRD, but also to satisfying client demands, given that Steti is targeting an ecologically aware export market.

The logs supplied to Steti are purchased from regional Czech forest consortia, including public and private owners, and from wood trading companies. These suppliers operate under licensing and control by the Forest Authorities. Forest ownership in the Czech Republic is subject to a national Forest Management Plan, based on sustainability principles, dating back to the nineteenth century and revised on a ten-year basis by the Ministry of the Agriculture. Implementation of the plan is enforced by the Ministry of the Environment via inspections.

The company long term development plans were shaken when Stratton Investments, a US investor, launched a carefully

stage-managed raid on the Czech industry. Stratton bought large stakes in eight Czech companies in a \$140 million deal with Harvard Investment Fund, the majority owner of SEPAP. The two investment companies became majority share holders of SEPAP effectively preventing AssiDoman from completing its long term strategic plans of increasing investment and control in SEPAP. At that time, there was no obligation on shareholders in Czech companies to disclose their interests. This enabled the deal to be done silently over the preceding few months. Nomura Equity Research was quoted as observing that the Stratton move was "less like an injection of management expertise into the Czech industrial sector than an attempt to make AssiDoman pay a fuller price for its intended acquisition of SEPAP."

A.2.1. Environment Development Interaction in Pulp Plant Modernization

The chlorine free technology is the latest equipment available on the market and represents the "greenest" solution available in pulp and paper production. The following values of COD and AOX are volumes produced by different stages of production process (Table A.1: on page 279). Vol-

umes at the end of pipe (River Elbe) are lower because they are treated in waste treatment plant whose efficiency is 55% for COD and 23% for AOX.

Phase of the project	COD (t/y)	AOX (t/y)
Phase A - the situation before the project Kamyr digester; chlorine bleaching 100 thousand tons of pulp per year	7000-8000	800
Phase B - the current situation Super Batch cooking plant, chlorine bleaching 100 thousand tons of pulp per year	3500-4000	400
Phase C - financed by CROCO Super Batch cooking plant, oxygen delignification, ECF bleaching 140 thousand tons of pulp per year	2300	140
Phase D - the final step Super Batch cooking plant, oxygen delignification, TCF bleaching 140 thousand tons of pulp per year	2300	10

Table A.1: Volumes of Pollutants Discharged from Production Processes in SEPAP by Stages of Modernization

Further environmental benefits of the project are due to environmental audit required as a condition to financing from the EBRD. The audit looked particularly at non compli-

ance issues, potential liabilities associated with current or past site use, energy utilization, and wood supply for pulp and paper production. The audit found

- non compliance issues existed in the areas of air emissions; waste water discharges to the River Elbe, including industrial effluent and storm water runoff, and waste management;
- there was a potential liability arising from existing subsurface contamination and activities of third parties operating on site;
- municipal waste was disposed at the facility landfill;
- energy utilization and inefficiency at SEPAP constituted a major share of production costs and represented an area with significant environmental impact, primarily from air emissions, similarly to most pulp and paper production facilities;
- wood supply: the supply of sustainably grown and harvested wood is critical not only to meeting the policy requirements of the Bank, but also to satisfying client demands, considering the SEPAP was targeting an ecologically aware export market.

Consequent to the environmental audit, an Environmental Management Plan was devised that will address the above issues.

Demand for TCF pulp (totally chlorine free) originated in Germany in 1989 in response to active campaigning by Greenpeace to eliminate use of chlorine and chlorine compounds in bleaching. The issue was supported by integrated sulphite paper producers in Germany and Austria. Sulphite pulp producers find it relatively inexpensive to eliminate chlorine and chlorine dioxide in bleaching and replace this with hydrogen peroxide to produce pulp of acceptable brightness.

Bleached kraft (i.e. sulphate) pulp producers have responded by dramatically reducing use of elemental chlorine and substituting chlorine dioxide to produce ECF (elemental chlorine free) pulp in quality comparable in strength and brightness to standard grades. Today, the production of TCF is a result of market demand and legislation and pertains primarily to German speaking Europe and partially to Nordic countries. The TCF issue is less significant in other countries where ECF process is generally considered as sufficient in its capability to protect the environment.

By 1993, ECF pulp became a standard in Western Europe (77% of total bleached pulp sales). The TCF pulp represented 13%

of bleached pulp sales in Europe, but in Germany it counted for 22.5%, in Austria 35%, in Switzerland 33%. Today it is practically impossible to sell chlorine bleached pulp in Germany. Many producers in Germany, Switzerland, and Austria demand only TCF pulp for their use (particularly tissue producers and some printing paper producers). Moreover, sulphate pulp is not produced in Germany because of public opposition to foul odors accompanying all sulphate pulp production. The craft pulp producers in the former East Germany were also closed down after the unification. Thus Germany offers a unique opportunity of being the biggest pulp and paper market in Europe, but where no sulphate pulp is produced. It is also a market of demanding and environmentally aware consumers. Switching to ECF and TCF pulp and paper provides SEPAP a unique opportunity to introduce new product on German market and increase production capacity at the same time. SEPAP will also improve quality of its products and increase portion of higher value added products. SEPAP's competitive advantage lies in its geographical proximity which reduces transportation costs to market, and in lower labor and wood costs. The improved quality is necessary to compete successfully in key export markets: Germany, Italy, France, and Benelux. The response to the environmental issue

(production of TCF and ECF pulp) is instrumental to entering the German market with pulp, as the German market requires this type of pulp. Totally chlorine free technology is the latest equipment available on the market and represents the "greenest" solution available in pulp and paper production. By reducing bleaching cost by half, the technology also represents substantial cost savings. Both pulp and paper markets are cyclical. The last industry cycle bottomed out in 1993 and prices for pulp and paper have been rising since early 1994. The company believes that investing in increasing production capacity in the time of recession saves the company large sums of money because suppliers and construction companies facing decline in demand reduce their prices. The SEPAP's modernization falls partly into such a slump demand. Also, devaluation of Swedish currency reduced payments to those Swedish suppliers of machinery who already signed their contracts.

SEPAP has little competition domestically. It is the only Czech producer of sulphate softwood pulp. Two other companies are suppliers of pulp to the Czech Republic - Biocel Paskov and SCP Ruzomberok, Slovakia. Neither of them is a serious competitor. Biocel produces sulphite pulp which competes with sulphate paper only on the margin; Rozumberok

produces hardwood sulphate pulp which has shorter fiber than softwood and thus also cannot substitute for Steti's product. The only other producer of pulp is JIP which uses all of its sulphite pulp in its own paper production.

In the domestic market, the key customers of SEPAP are cement works buying paper sacks. Demand for this product is expected to grow due to increased construction and renovation activity and consequent higher retail sales of cement. In the long term, however, the demand may turn into a decline once the peak years of renovation work are over.

Within its industry, Steti is very cost competitive. Distribution costs, labor and wood are the main components in which Steti has an advantage in the supply of bleached softwood kraft pulp. Steti's pulp production lines have a total capacity of 350,000 t/a which will be raised to 390,000. With its current size Steti belongs to the medium-sized pulp mills, the most modern pulp mills in Europe have a capacity of 500,000 t/a.

In all its production lines, Steti's competitive advantage lies primarily in lower labor costs, strategic location, its integration with pulp production as well as favorable wood costs. Labor costs in Steti are only one tenth or even less of those in the Western European paper industry. At current

exchange rates, Steti's wood costs are comparable with those of Austrian mills, but lower than those of Scandinavian mills and not far higher than the wood costs of the low-cost North American producers. By investing into TCF technology, Steti will become after Scandinavian companies one of the first companies in the world producing TCF, directly competing with the best pulp companies.

Current major cost disadvantage of Steti lies in energy costs. Purchased power prices are higher than in Scandinavia though lower than in other Western European countries. Energy consumption in Steti is very high in comparison with other European producers. The EBRD is currently exploring assistance to Steti in this area. Improving energy efficiency would bring further environmental and economic benefits.

Modernization of Steti is expected to have important employment impact. SEPAP is the sole employer in city of Steti and a major one in the whole region. The project will have an impact on almost 2,700 current employees.

The Czech Republic will also derive economic benefit from strengthened export abilities of the country (almost 2% of country's export) and support of economic growth. Due to the size of Steti, the project will have a substantial multi-

plier effect on regional economy. The positive economic benefit is somewhat reduced by undervalued Czech currency together with net inflow of foreign currency. The calculation of the economic rate of return was not performed because the company does not benefit from any subsidies. The ERR would be higher than the IIR, essentially influenced by the amount of taxes paid by the company. The Internal Rate of Return was positive. Sensitivity analyses showed that the IRR would decline slightly if CSK appreciated.

A.3. The Power Plants Modernization Case

Czech Republic power demand is serviced by electric utility Czech Energy Enterprises (CEZ) which dominates the country. CEZ supplies all the households and most of industry in the Czech Republic. A small fraction of capacity is derived from industries generating their own power, with any surplus being sold into the grid. CEZ capacity totals about 10,235 MW out of the country's total capacity of 13,826 MW. Of this, about 7,257 MW is generated by fossil fuels, 1,218 MW by hydro and 1,760 MW by nuclear. The power system is heavily dependent on coal. Primarily, brown coal of low calorific

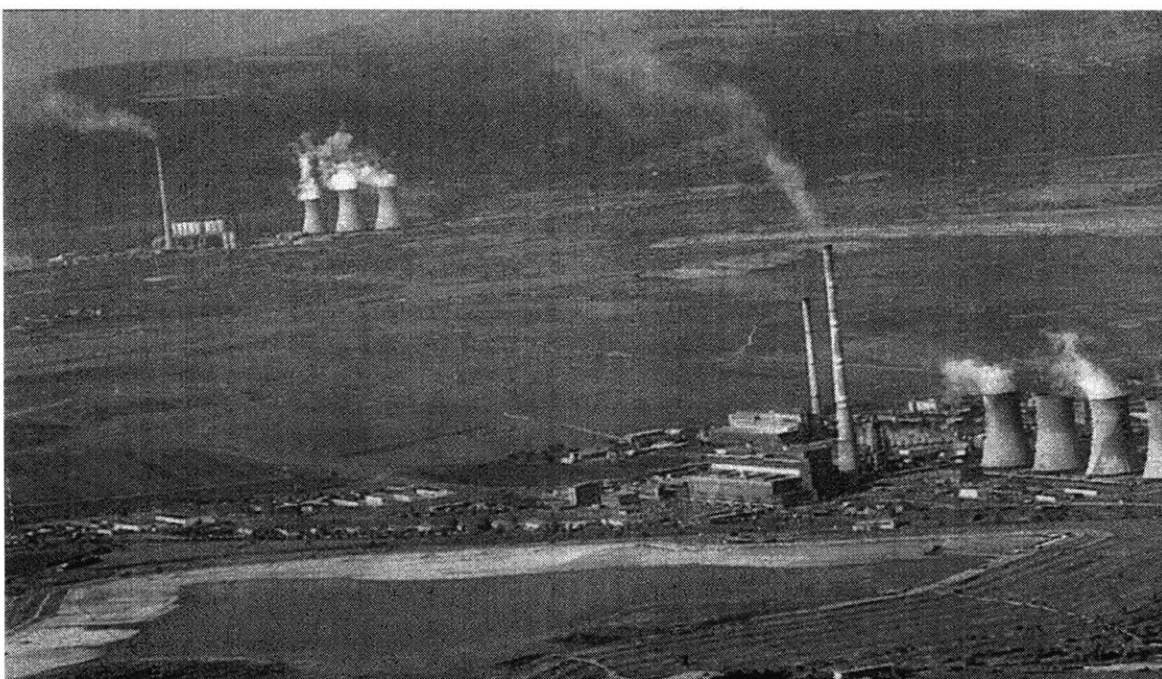


Figure A.18: Power Plants in Northern Bohemia

value and high sulphur content is used. This coal burned without desulphurization equipment results in high emissions of sulphur dioxide, nitrogen oxide, and fly ash.

The main coal power plants are concentrated in the North Bohemia region and include Melnik II, III, Pocerady I, II, Prunerov I, II, Tusimice I, II, Ledvice I,II, and Tisova I,II (Table A.2: on page 288).

The predecessor of the Czech Energy Enterprises (CEZ), the Czechoslovak Energy Enterprises, was first established in 1945. At that time, it managed seven energy enterprises. In the early 1950's, the CEZ was dismantled when its role was taken over by the state administration. The energy enter-

Table A.2: Coal Fired Power Plants Operated by CEZ (by 12/31/1994)

Power plant	fuel	capacity MW	year commissioned
Tisova I	brown coal	2x50, 2x55, 1x12	1959-1960
Tisova II	brown coal	1x100	1961
Prunerov I	brown coal	4x110	1967-1968
Prunerov II	brown coal	5x210	1981-1982
Tusimice I	brown coal	2x110	1963-1964
Tusimice I	brown coal	4x200	1974-1975
Pocerady I	brown coal	3x200	1970-1971
Pocerady II	brown coal	2x200	1977
Ledvice I	brown coal	1x200	1967
Ledvice II	brown coal	3x110	1966-1969
Melnik II	brown coal	4x110	1971
Melnik III	brown coal	1x500	1981
Chvaletice	brown coal	4x200	1977-1978
Dvur Kralove	brown coal	1x6,3/1x12	1955,1963
Porici	black coal	3x55	1957-1958
Nachod	brown coal	1x5/1x12	1950,1969
Hodonin	lignite	1x55/2x50	1954-1958
Detmarovice	black coal	4x200	1975-1976
total		7,257	

prises were then managed by the department called the Main Administration of Power Plants. This organization was part of the Ministry of Energy between 1954-1958. From 1952 to 1956, power generation was managed through six "energy trusts" - Praha, Most, Hradec Kralove, Brno, Ostrava, and

Bratislava. In 1956, the Energy Trusts were replaced by three Main Administrations - Praha, Ostrava, and Bratislava. Another special administrative unit, the Czechoslovak State Energy Dispatching Center, was established in 1956 to ensure efficient utilization of power and to equalize load in the power transmission system. From 1956, the top administrative unit in power production was the Central Energy Administration.

The new history of the CEZ began on July 1, 1965, when part of the Central Energy Administration was joined with the Czechoslovak State Energy Dispatching Center to form the Czechoslovak Energy Enterprises. The CEZ grew into a large state owned vertically integrated monopoly organization employing almost 58,000 people.

With the establishment of the Czechoslovak federal system of government, the Czechoslovak Energy Enterprises were divided into two national companies - the Czech Energy Enterprises (CEZ) and the Slovak Energy Enterprises (SEP). This division came into force from January 1, 1969.

Another transition awaited CEZ after the economic and political reforms of 1989. In 1990, the power distribution utilities (REAS) were separated out from the CEZ to form autonomous state owned enterprises in order to reduce monop-

only power of the CEZ. Eight independent power distribution companies were formed as follows:

- Prague Power Works
- Middle-Bohemian Power Works
- South-Bohemian Power Works
- West-Bohemian Power Works
- North-Bohemian Power Works
- East-Bohemian Power Works
- South-Moravian Power Works
- North-Moravian Power Works

The CEZ was further restructured by the decision of the Economic Advisory Council of the Government of the Czech Republic from April 14, 1992. The state privatization project divided the CEZ into three separate organizations: the CEZ, a.s. (49,181 million KC), ENERGOVOD, a.s. (346 million KC), and ORGREZ, a.s. (98 million KC). Consequently, the CEZ was transformed into a joint-stock company 100% state owned but able to plan raising capital through partial privatization. The company submitted a plan to the government proposing that 30% of its shares be included in the first wave of the voucher privatization taking place between the end of May and 9 June, 1992. The plan was approved by the

government and the shares sold to the public. The National Property Fund kept 71% ownership after the first wave of privatization and then reduced it to 67% in the second wave. The economic ministry decided to give the state the 67% golden share until an energy policy is devised for the Czech Republic later on. The management at CEZ hoped that the early sell-off would help to secure bank loans for its program to raise money for environmental improvements and modernization.

Further restructuring proceeded on basis of individual privatization projects which spun off the following enterprises from the CEZ: Heat Enterprises Prague (4,225,473 thousand KC), Power Plant Opatovice (1,170,419 thousand KC), South Moravian Energy Enterprises (926,439 KC), Ostrava-Karvina Energy Enterprises (2,743,583 thousand KC), Teplice Machine Works (235,791 thousand KC), Energy Machine Works Brno (152,156 thousand KC), Energy Machine Works Velke Mezirici (96,890 thousand KC), Energy Shops Pardubice (46,339 thousand KC), Energy Construction Liberec (145,183 thousand KC). These restructurings and privatizations were lead by the logic of focusing the CEZ on its core business of electricity generation, transmission, and sale. The new companies spun off were mostly in the business of heat genera-

tion or power plant maintenance. At the end of the restructuring, number of CEZ's employees dropped from 58 thousand to 17 thousand.

Internally, the CEZ was struggling with disintegrating forces unleashed by the political and economic changes. Anxiety caused by the past practice of gathering financial resources in the center and redistributing them according to political influence and personal favoritism drove individual organizational units of the CEZ to demand autonomy. They were particularly concerned that financial means required for modernization of their individual power plants would instead be diverted to completion of the nuclear power plant in Temelin. The expense of this project (about 40% of CEZ capital expenditure plan) would mean that they would subsidize construction of a plant that would make them ultimately obsolescent, perhaps out of job.

At the peak of the controversy, union members at the Northwest Electric Works protested to the Czech prime minister Vaclav Klaus about the way the CEZ was being privatized. They demanded that the supply monopoly is broken up into five smaller, competing companies as outlined in their privatization proposal which would have made their unit independent from CEZ.

The senior management of the CEZ disagreed with immediate vertical disintegration that would lead to the establishment of several independent electricity generating companies and a national grid company. They viewed such efforts as "unwise and irresponsible", unless supported by a regulatory body ensuring reliability of supply. If disintegration went ahead, CEZ's ability to raise the legally required \$2 billion for pollution control equipment to its coal-fired power plants would be dissipated amongst several small companies. Disintegrated enterprises, they argued, operating in a competitive market with consumption levels falling "would provoke 'dumping prices', not facilitating large ecology project investment, nor power station rehabilitation and, above that, resulting incorrect price-signals could be sent to consumers." They also pointed out that CEZ already had "a painful lack of proficient, capable, well-trained, market-oriented managers even in the existing structure." A disintegrated industry would only exacerbate the problem.

During this period of organizational restructuring and privatization, the CEZ came under intensive pressure from the public who just found political freedom to express their concerns. Public discontent with the CEZ focused primarily on air pollution in Northern Bohemia and its environmental

and public health consequences. This issue was closely linked with looking for alternatives to energy generation in thermal power plants. It appeared that the only viable long term option for the country was in direction of nuclear power generation. However, this solution also attracted many vocal opponents.

Due to the heritage of past planning, most of the large thermal power plants operated by the CEZ were concentrated on a relatively small area in Northern Bohemia. The power sector relied heavily on these coal-fired power plants burning low-quality high-sulphur lignite which was mined in the region. They represented the largest polluter in the country in regard to SO₂ and dust (fly-ash and particulate matter). The extensive use of lignite during the past 40 years resulted in a large environmental damage which was particularly serious in Northern Bohemia region where large parts of the forests have died and health of the population was declining. During incidents of air inversions, which were exacerbated by poor ventilation due to surrounding mountains, local people frustrated with the situation gathered and threatened to occupy the power plants and close them down by force.

While the population of Northern Bohemia was expressing their frustration with air pollution caused by the CEZ operated plants, South Bohemian population supported by international and domestic radical environmental groups engaged the CEZ in a protracted conflict over completion of the nuclear power plant in Temelin. The issue of the nuclear power plant gained on salience when the neighboring Austria took steps to protest completion of the Temelin plant in various international fora claiming that the plant, built according to Soviet design, was inherently unsafe even if it were equipped with modern Western control instrumentation.

During the period of political turbulence of 1991, the Czechoslovak Federal Committee for the Environment passed a new Air Pollution Law #309/91. This law was followed by a Resolution of the Federal Committee for the Environment from June 23, 1992 which specified strict standards on sulphur dioxide (SO_2), nitride oxides (NO_x), particulate matter, and carbon monoxide (CO) for stationary sources of emissions with thermal energy output above 5 MW. These strict standards applied to new sources of emissions. For the existing sources of emissions, the law provided for a scale up period of 7 years within which all the major sources of air pollution would be required to comply. Consequently, departments

of the Czech Environment Inspection issued specific permits and schedules for individual sources within which they had to comply. The latest date specified by the law for coming to compliance was given as December 31, 1998.

The standards adopted in the new law were intended to bring the country up and harmonize it with practices in the European Union to whose membership the Czech and Slovak Republics aspired. Needless to say, none of the CEZ's power plants was equipped with pollution control device that would be in compliance with requirements of the new law.

In the past, the CEZ made one costly experiment with a prototype of a Soviet designed flue gas desulphurization unit to clean air emissions from its power plant. The Soviet technology was never tested in operation before, but the CEZ did not have the freedom to choose technological designs at that time. The political decision of the supervising agency prevailed so that the CEZ had to tie itself to the Soviet supplier. Unfortunately, the Soviet supplier never managed to put the scrubber into proper operating condition. Buildings were constructed, equipment purchased, but the scrubber never worked. The CEZ wasted 1,500 million KC on this ill fated experiment.

After this disturbing experience, the CEZ decided against further experimentation. Fortunately, opportunity opened to work with established industry contractors with a sufficient experience and a record of past successful constructions. Also, the CEZ sought to improve its battered image of the worst polluter in the Czech Republic who was ignorant of environmental and health damage imposed by its operations.

When the new air pollution law was passed, the CEZ did not contest it. Instead, it defined its problem as a need to comply with the regulation and to improve its public image. It embarked on an unprecedented long term program of cleaning air emissions from its power plant whose cost was estimated at 36,600 million KC (about \$13 billion). The goal of the program was to reduce emissions of SO₂ by 90%, emissions of fly ash by 80% and emissions of NO_x by almost 50% by the year 2000. The plan contained eight components:

- Completion of the nuclear power plant in Temelin which will gradually substitute capacity to decommission some coal fired blocks and reduce utilization of the others;
- construction of flue gas desulphurization to reduce air emissions of sulphur dioxide in large and medium

coal fired blocks; between year 1994 and 2000, 29 coal fired blocks will be equipped with scrubbers at the cost of 27,000 million KC.

- Replacement of five existing boilers with new fluidized bed boilers in power plants that combine power and heat generation;
- Improvement of coal quality in combination with burning natural gas in two power plants;
- Retirement of old coal fired blocks;
- Implementation of primary measures to reduce emissions of nitrogen oxides;
- Repair or replacement of existing electrostatic filters;
- Increasing energy efficiency.

A key feature of the CEZ's environmental management plan became the decision to equip all remaining power plants with flue gas desulphurization units (scrubbers). But some analysts were uncomfortable with attaching new scrubbers to some of the aging power plants. They believed that while the

scrubbers would last 15 years, some of the power plants had shorter operating time. They saw this incompatibility in operating time for the scrubber versus that of the plant as an attempt of the plant managers to sink in capital investment that would prevent closing the plant early in the future. Czech language owns a special phrase for this behavioral strategy - "construction of monuments" (stavění pomníku).

Technological capacity also proved constraining on this program. Scrubbers are an end of pipe technology which reduces emissions of sulphur dioxide to the air, but it creates a significant amount of solid waste instead. Alternative technological solution, fluidized bed combustion is available only for small and medium size boilers. Switching to an alternative supply of fuel such as low sulphur black coal would also be a potential solution. However, most local coal supplied to power plants is and will remain high sulphur content brown coal in the near future. Although power plants are no longer obliged to buy coal from a specific domestic supplier, government policy puts a quota on imports of foreign coal in order to support employment in domestic mines.

Some attempts have been made in industry to design regenerative scrubbing processes. In such a process, a chemically

active substance returns into the scrubbing process after contact with sulphur dioxide. This is in contrast to non-regenerative processes in which chemically active substance leaves scrubbing process as a waste or as a secondary material to be used in other production processes.

One of the better known regenerating processes is based on scrubbing sulphur dioxide with liquid containing Manganese Oxide (MgO). This process leads to combination of $MgSO_3 \cdot 6H_2O$. This substance is dried up, and broken by heat treatment on two substances MgO and a gas containing SO_2 . This gas may further be processed to produce sulfuric acid (H_2SO_4). The other component, MgO returns to the scrubbing process. The advantage of this technological method is that it produces little waste at the end. It also achieves high efficiency up to 90%. However, the ill-fated experiment with the Soviet scrubber was based on this technological method. After its costly mistake, the CEZ decided to adopt more conventional technologies proven to work.

The most broadly used approaches measured by installed capacity are non-regenerative. These processes employing calcium are either wet, semi-dry or dry. All scrubbers the CEZ will build are either wet or semi-dry. In the wet processes, sulphur dioxide is captured in liquid. In semi-dry

processes, chemically active substance is injected in liquid form into a stream of hot emission gases. When this liquid evaporates, the product of the reaction leaves in a solid state.

The wet scrubbing processes are relatively effective and inexpensive. Most world installed capacity (80%) is based on wet scrubbing. Wet scrubbing comes in three forms:

i) calcium-sludge

Sulphur dioxide is scrubbed with dissolved calcium. Resulting sludge, containing $\text{CaSO}_4 \cdot \text{H}_2\text{O}$, $\text{CaSO}_3 \cdot 1/2\text{H}_2\text{O}$, CaSO_3 , and CaO , is partially dried up and stored in a landfill. The drawback of this approach is that its product is not chemically stable and it takes up a lot of disposal space.

ii) lime - gypsum

This approach is similar to the above, but the removal of sulphur dioxide proceeds in two stages. First sulphur diox-

ide is scrubbed with dissolved lime to produce dihydrite calcium sulphite ($\text{CaSO}_3 \cdot \frac{1}{2} \text{H}_2\text{O}$). This solution, mixed with sulfuric acid (H_2SO_4), is oxidized in a reactor to produce dihydrite calcium sulphate ($\text{CaSO}_4 \cdot 2 \text{H}_2\text{O}$).

iii) limestone - gypsum

This method is the most widespread. Sulphur dioxide is scrubbed with dissolved limestone. This reaction produces sulphite which is oxidated to produce sulphate. Heat treating of this substance in calcining kiln produces so called power-gypsum which can be used in construction industry or as a stabilizer for disposal of ash.

The main drawback of the scrubbing technology is in that it is an end-of-pipe solution which leaves substantial amount of waste from a production process. A boiler of a 200MW block burning brown coal produces about 1 050 000 Nm^3/h of gases with concentration of sulphur dioxide of about 6,500 mg/Nm^3 . With 95% scrubbing efficiency, about 6,480 kg of sulphur is captured per hour. To remove this sulphur dioxide, 9 t/h of limestone is used which leaves 15 t/h of gypsum. It has been estimated that about 1.7 million tons of power gypsum will be produced in 1999 when all the scrubbers

have been built. According to estimates, the Czech market is able to absorb about 750,000 tons of power-gypsum.

Since the life-time of a scrubber is at least fifteen years, the current investment program in fact freezes conventional, but environmentally not quite satisfactory technology for a long time.

As any other Czech and Slovak company during the time of transition, the CEZ struggled to secure financing for its environmental program. The financial needs of this program were enormous estimated at \$2 billion. But the CEZ was too important to be left without any government help. As much as the Czech government insisted on its policy of not providing sovereign guarantees for loans to industrial enterprises, it did provide the guarantee to the CEZ. With this guarantee, the CEZ was able to secure first financing from the World Bank in 1992, the Environment and Power Improvement Loan of \$246 million.

The Environment and Power Improvement loan was the largest environmental loan ever given by the World Bank at that time. It was signed between the World Bank, Czechoslovak Federal Ministry of Industry and the CEZ. The loan was granted with a ten year repayment period, following a grace period of five years at a rate of interest described as half those usual in

Czechoslovakia. The size of the World Bank's loan reflected the Bank's concern over air pollution from electricity production in former Czechoslovakia and Northern Bohemia in particular. According to a senior World Bank economist for the region, "on per capita basis, pollution in Czechoslovakia was the highest in Europe, and pollution in Northern Bohemia was 10 times the average in the country."

The loan consisted of five related elements: the installation of a flue gas desulphurization unit at the Prunerov II power plant; the retrofitting with new electrostatic precipitators for effective control of dust at selected power plants, efficiency improvement programs at selected plants; a program to upgrade the transmission system including interconnection with UCPTE network, technical assistance in the implementation of accounting practices and financial and information management to bring them up to international standards.

The World Bank loan provided an important step for increasing financial credibility of the firm. It was also connected with technical assistance for further planning. But the CEZ needed more money while further government guarantees were not available. In this situation, the CEZ adopted an innovative strategy of financing. It decided to

increase transparency of its financing practices and build corporate image by inviting an international auditing firm, Anderson Consulting, to review its financial report. Further, it invited Standard & Poor's rating agency to be granted BBB- investment grade credit. Another credit rating, A-, was awarded to CEZ by the Japanese agency JBRI. CEZ thus became the only Eastern Europe's company with an investment grade debt rating.

The effort for financial transparency paid off. On the strength of the credit rating and with the World Bank loan in reserve, CEZ became a fore-runner in using domestic and foreign credit sources to help finance its \$2 billion desulphurization project.

Pursuing its innovative financial strategy, CEZ was able to issue successfully three emissions of bonds on domestic capital market and one emission of Eurobonds. The first emission, a 2.3 billion KC (\$79.3 million) medium term domestic bond issue, was released in June 1993. The crown valued obligations carried a five year maturity on a fixed rate of 16.5% compounded annually. This issue was followed by the second 4 billion CK issue in January 1994 with a stable interest rate of 14 3/8% annually. The second issue will

mature in 2001. Ceska Sporitelna lead-managed both issues with other Czech banks also participating.

The success on the domestic financial front was followed by a successful placing of five year bonds on foreign capital market. The emission of \$150 million US in Eurobonds was facilitated by the American investment bank J.P. Morgan Securities Ltd. The bonds were priced at a slight discount to their face value at 99.78 with interest set at 110 basis points over the rate paid on US treasury bonds. The Eurobonds, which carry interest of 8.875%, set the stage for other large East European companies looking to finance their modernization projects. The CEZ thus became the first East European industrial enterprise that successfully introduced its bonds on European capital market.

The third domestic issue set a new course taking over the government's traditional role in providing a debt benchmark. CEZ, taking advantage of its favorable market position, issued a 4 billion KC (\$154 million) tranche of 10-year bonds in May 1995. The issue was lead managed by Dutch group ABN-AMRO, Czech savings bank Ceska Sporitelna, CS First Boston and Zivnostenska Banka. A host of other banks were involved: Agrobanka, Obchodni Banka, Komerčni Banka, U.S. Citibank, Germany's Commerzbank and the Netherlands' ING Bank. The

third issue doubled the maturity dates of other Czech issues and could mark a significant step forward for Czech companies seeking long-term domestic capital.

Market analysts observed that unlike the case of most Western countries, where state issues set standard, CEZ bond, with a coupon of 11.3%, would be the benchmark since the government had not issued a bond with a maturity longer than five years. "CEZ is the most sophisticated issuer on this market and is really fulfilling the role that treasuries should be doing," an analyst was quoted saying. CEZ on its part would prefer to raise all its capital on domestic market to avoid currency exchange risks, but it had to reach abroad again because domestic capital markets were not large enough for its needs.

A stiff competition from the syndicated loans market, where borrowers can achieve significantly cheaper funding than in the eurobond market, led CEZ to seek a loan from western commercial banks. The reward for this change was significant when CEZ arranged a \$100 million three year syndicated multi-currency revolving loan at 25 basis points over Libor. CEZ's issue of Eurobonds from December 1994 would have swapped into US dollars at Libor plus 70 basis points.

In 1995, competition among Western banks to provide credit to large Czech firms drove down financing costs for monopolies such as CEZ while squeezing margins for Western banks. The loan to CEZ started the spiral. The winning lead arranger, Summitomo (Japan) beat some 30 other banks with its bid of 25 basis points over Libor, the lowest rate afforded to a Czech company since the fall of communism. Summitomo underbid European and American banks because Japanese institutions view companies like CEZ as quasi- sovereign debt; they see state majority ownership as a government guarantee. This reasoning led Summitomo to insist on only two financial covenants: the CEZ's debt must not rise above 50% of capital, and that the government maintain majority control of the company during the life of the credit.

The CEZ-Summitomo deal set another benchmark to which other companies adhered or tested. CEZ was the first Czech company, including banks, which has obtained such a type of loan. Consequent loans to large Czech companies were achieving spread of 25 basis points or even lower. Both domestic banks as well as utilities enjoyed the lower cost of capital. The continuing high cost of finance in the neighboring Hungary, the region's rival as fast track reformer, could be seen when telecoms operator Matav took out a \$300 million

syndicated loan with spreads of 160 and 150 points over Libor in July 1995.

The strategy of seeking financing through raising funds directly on capital markets rather than through project specific loans made financing of the environmental program cheaper than it would have been otherwise. The CEZ was in a better position to follow the strategy of financing its capital expenditures through general credit because it preserved association of the power plants. Had the power plants have gained their independence, such as was the case in Poland, raising money for modernization and environmental improvements would have been much more difficult. The individual plants pose a higher credit risk than a pool of them associated in one organization.

A.3.1. Environment Development Interaction in Power Plant Modernization

The most significant environmental benefits will be reached in reducing air pollution (Figure A.19:). Emissions of sulphur dioxide should decrease 90% by the year 2000.

Within the program for retirement of the oldest coal-fired plants, 12 heating blocks with total energy output of 1235 MW

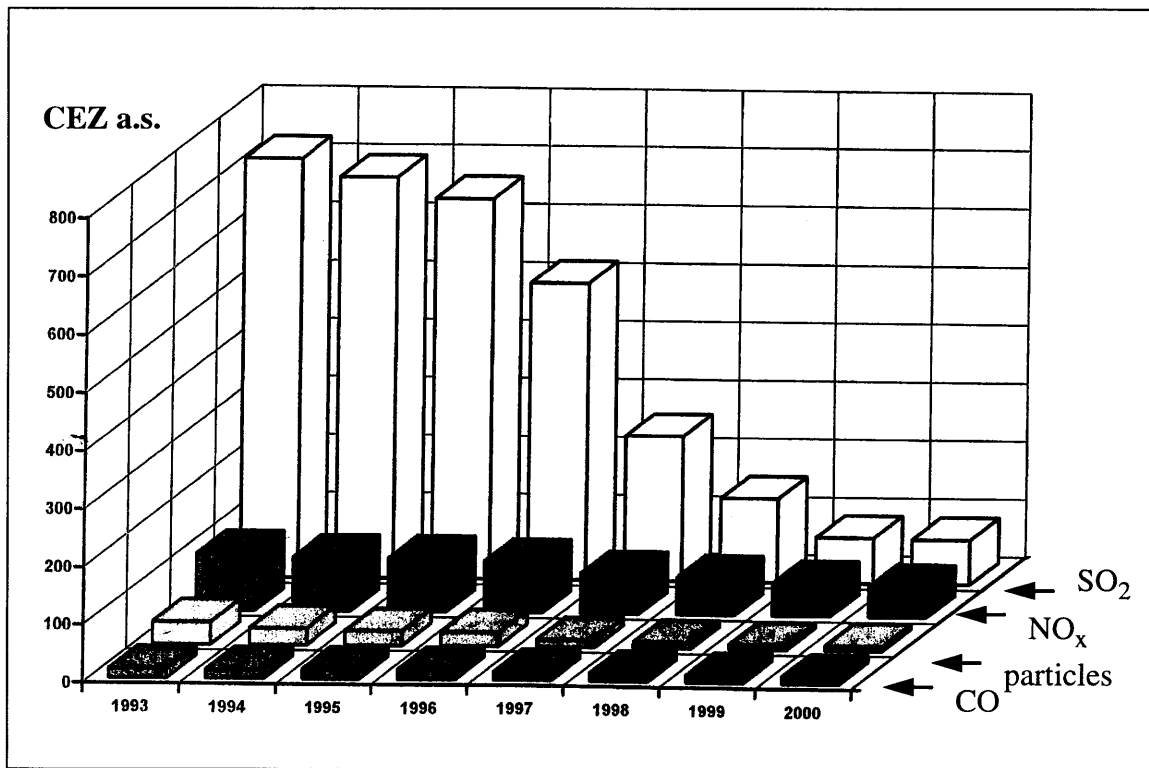


Figure A.19: Projected Emissions from CEZ Power Plants

were closed down. Another output of 2,230 MW is planned for closure by January 1999. These power generating blocks were found too obsolete to be modernized efficiently.

The main assumption in the proposed program of retiring the oldest coal-fired power plant capacity is that the planned completion of new capacity from the Temelin nuclear power plant will be sufficient to supply energy demand of the country. Energy demand dropped somewhat with decreased industrial productivity during the period of transition. However, energy demand may increase if energy efficiency is not encouraged.

The key condition determining environmental and economic benefits of an energy utility lies in energy prices and rates. Energy efficiency is promoted when prices of electricity are set at least at the level of actual production cost. Increased prices of energy also lead to higher returns to the CEZ and make its operations more profitable.

The CEZ's environmental program does not mostly lead to increased financial returns. It makes it possible for the CEZ to operate in compliance with environmental regulations and avoid closing down its power plants or investing in building new expensive plants. From the perspective of the firm, the joint benefits would be achieved if electricity prices were increased or more electricity was sold or production costs were reduced in relation with reduced emissions of pollutants. In a way, this relationship is political for a monopoly energy producer like the CEZ which is 67% owned by the state and which supplies about 80% of the country's energy needs.

From the broader perspective of Czech economy, the expense of the pollution control program would have to be balanced against external cost to the country of pollution. This cost is not internalized adequately at present even though pollution charges are levied on units of emissions. For example,

Table A.3: compares emissions charges with costs of lime and limestone used in flue gas desulphurization units. It is apparent that costs of operating the scrubbers (limestone being the main input) by far exceed the current emission charges the CEZ pays. The cost to the economy of damaging forests and human health is not reflected adequately in pollution charges and consequently in balance sheets of an individual firm unless legal directive forces the firm into compliance.

Table A.3: Emission Charges vs. Limestone Costs (mill. KC)

	1993	1994	1995	1996	1997	1998	1999	2000
Fly-ash	37	57	49	66	49	42	28	27
SO ₂	223	430	407	436	292	192	93	91
NO _x	24	46	46	59	59	56	48	44
CO	3	6	6	8	8	9	8	8
total	287	539	508	569	408	299	177	171
lime and lime- stone	0	5	59	235	525	707	806	780

Also, until recently, costs of coal and labor, which are the main production input, were set administratively. Mines belonged under the same administrative unit as energy utilities and power plants. The state planners were biased towards developing mines and cross-subsidizing them from the

other production units and from the state budget. Mines were significant not only in the planned system's overreliance on heavy industry, but also politically as a power base of the workers and the communist party.

Along with subsidizing heavily operating costs of mines and wages of miners, prices of coal were kept low in order to support industry and households. Coal belonged to the category of "essential goods" that were priced low so that they could be available to everyone.

The future coal mine restructuring is potentially troublesome issue for the government due to its impact on employment. Coal production has fallen a quarter since 1989 and is expected to drop another quarter by 2005. Additional mine closures will require government policy coordination and assistance including price support. But with gradually liberalizing costs of coal as the main production input, power plants would incur higher production cost that would better reflect true costs of producing electricity. Also, power plants are allowed to purchase higher quality coal from alternative sources with liberalization.

However, an increase in energy rates is politically very difficult. CEZ has to operate with incentives to meet both environmental and financial standards set by the government.

The government, as both majority shareholder and regulator, may find it hard to make unpopular tariff decisions or avoid the temptation to intervene in company investment and management.

The government has to balance its political goals against profitability of an individual firm. Development strategy of a country dictates that energy be cheap in order that industrial competitiveness is maintained. Also, the Czech government is sensitive to potential inflationary effects and social fallout of higher residential energy prices.

At the time of soaring prices, Czech households and industry would not appreciate yet another price hike. In December 1990 and May 1991, industry was subjected to increases of 53 percent and 80 percent, respectively, and in October 1991 households had to swallow a 70 percent increase in domestic tariffs. In 1994, officials at CEZ were disappointed with a Czech government decision to raise household electricity prices only 12%, an increase just over the rate of inflation currently running at 10%. CEZ wanted an increase of 35%. So far, the Czech government has not established a schedule for full energy price liberalization and hardly will do so before elections scheduled for 1996.

Ministry of Finance, which can change regulated energy prices, released a statement on September 6, 1995 that said discussions about increases were taking place between Ministry of Finance and Ministry of Industry and Trade, but the government's position of gradual price increases in residential charges still applied. Each year, commercial electricity customers cross-subsidize domestic consumers who pay less than half the price charged to the commercial consumers. This practice, among other results, discourages foreign investment in building power stations because an investment will not earn adequate returns due to the low price of energy.

In the meantime, households are rapidly converting to energy heating which appears economically viable at present low power prices. Unfortunately, this spontaneous rapid conversion to electricity heating in households will make later increase in power rates politically very difficult. In a country poor on energy sources like the Czech Republic, using electricity for heating is seen as "luxury" by some government officials.

As much as the CEZ will remain a dominant monopoly producer of power in the Czech Republic, its ability to sell the power is constrained by the capacity of the distribution

utilities to connect individual households and sell electricity. At present, the capacity of the low voltage grids is insufficient so that potential customers have to be turned down by the utilities. Also, some limited competition exists through imports of electricity from abroad. Foreign utilities are expected to be bidders in privatizations of regional distributors. CEZ strongly opposes allowing foreign investors, especially German utilities, into the distributors fearing that in the long term they could push for imports of electricity as a means of circumventing CEZ's virtual monopoly of supply.

CEZ has to negotiate prices of electricity with these power distribution utilities and share profits with them. So far, long term contracts with these distribution utilities have not been signed yet. In September 1995, the government imposed a price agreement on CEZ and the electricity distributors that gave the distributors an additional three percentage points of electricity price revenues. CEZ was reported to be infuriated by the imposition of the price-sharing agreement which will cut an estimated 1.5 billion KC (\$56 million) from its 1995 revenues and 800 million KC from pre-tax profits.

Thus the market will not regulate CEZ's economic performance in a near future. The main influence will be exerted by state regulatory agency as soon as it is established sometime in 1996. In the meantime, the State Property Fund as the main shareholder has the power to replace managers and influence behavior of the enterprise. Although some limited competition will be created on the marketing side by the existence of the independent distribution utilities, CEZ's economic performance and its environmental responsibility will be greatly affected by political and administrative processes which will determine the relationship of these two.

The joint benefits in this case are not exhausted by the position of the CEZ. Due to the extent of the air pollution and its transboundary impacts, the neighboring countries - Austria and Germany - can gain by investing into reducing pollution across their borders.

Austria, on its part, established an East-Eco Fund, a program to improve environmental conditions in Austria's neighbors, which will ultimately improve the Austrian environment. The fund has contributed about \$70 million to 81 projects since its launch in 1991, including projects approved for 1995. The fund receives its money from the Aus-

trian national budget. According to the Austrian Embassy in Prague, in 1991 Czechoslovakia exported 55 tons of sulphur emissions to Austria while Austria only sent 2 tons of sulphur emissions across the border to Czechoslovakia.

For example, the Austrian government and a consortium of foreign banks have assisted in financing a 3.4 MW hydroelectric plant in the Czech Republic. Austrian banks Creditanstalt and Girocredit, along with French bank Credit Lyonnais, lent CEZ \$6.6 million for the project while the Austrian East Eco Fund contributed an additional \$1 million. The rest of the cost was covered by CEZ from its cash reserves. Completion of the project will enable shutting down a nearby coal power plant which pollutes air.

According to the CEZ, though Austrian companies were the main technical supplier, no direct link between the awarding of contracts and the granting of loans and contributions existed.

Germany, on its part, awarded to the Czech Government a grant of \$14.8 million towards the installation of desulphurization equipment at coal fired power plants in the north Bohemian town of Prunerov. This city, near the borders of Germany and Poland, contains Czech largest complex of coal-

burning power generators, nine units in close proximity to each other.

Germany donated the money to the first phase of the project - the conversion of five generators - because some of its territory is affected by Prunerov's emissions. The grant, which represents about one-fourth of the overall cost of the program, will become a loan if Germany is dissatisfied with the results. The second phase of the project of reducing emissions in Prunerov will partially be funded from the World Bank loan.

A German company, Gottfried Bischoff, GmbH., won a competitive bidding process to supply the desulphurization equipment for the first phase. Senior managers at CEZ selected Bischoff from among nine foreign companies that submitted bids for the project three months before the German government contributed its 23.5 million DM grant.

In both rounds of bidding for the supplier of the desulphurization equipment, the World Bank is empowered to approve bid selection. The second round was won by a consortium of companies consisting of Mitsubishi Corp., Mitsubishi Heavy Industries Ltd., and ZVU Hradec Kralove.

In December 1994, Germany donated further grant of DM8 million for the modernization of Tisova lignite plant. This

grant was part of a larger package of DM40 million given in an agreement signed by Czech Ministry of Trade and Industry, Czech Environment Ministry and German Environment Ministry.

Electricity exports provide yet another means of achieving joint environmental and economic benefits. Electricity exports will provide means for financing desulphurization at Pocerady power plant. CEZ will provide drawing rights on 100MW, equal to annual supply of 650 GWh, of electricity from the Pocerady plant to Switzerland in the next 10 years. The contract obliges CEZ to use most of the proceeds to fit desulphurization equipment at the Pocerady coal-power plant by 1996 starting with Pocerady's Units 3 and 4 (400 MW). Plans include retro-fitting of desulphurization plant to reduce sulphur dioxide emissions, low nitrogen oxides technology, and electrofilters to control fly-ash. The contract also includes a possibility to interrupt electricity supplies under the occurrence of inversion situations in the Czech Republic.

Switzerland's largest regional electricity company, Nordostschweizerischen Kraftwerke (NOK), decided to go ahead on the deal to import coal generated electricity from the Czech Republic despite negative domestic publicity on the issue. NOK argued that this deal will lead to a drastic reduction in

emissions and that it has the right to inspect progress at the plant which has to be brought up to standards acceptable to the Swiss.

The last area of joint benefits has been achieved in utilizing waste from power generation. Conventional scrubbers leave significant amounts of power gypsum for further disposal. A joint venture of CEZ and Knauf (Germany) was formed to manufacture cardboard out of gypsum. The production was started at CEZ's power plant in Pocerady in November 1994. Besides gypsum cardboard production, gypsum can be used as cement admixture. Knauf manufactures 100% more of gypsum cardboard currently than had been originally estimated. CEZ plans to set up other joint ventures to use the material with RVE Pro-Minerali (Germany) and British Gypsum (UK).

A.4. The Aluminum Production Modernization Case

The production of primary aluminum in central Slovakia started on 29 August 1953, the Soderberg anode paste production used in the aluminum smelting process in 1954, and the aluminum oxide (alumina) production in 1956. In 1968, a foundry for sand mold high and low pressure casting was built

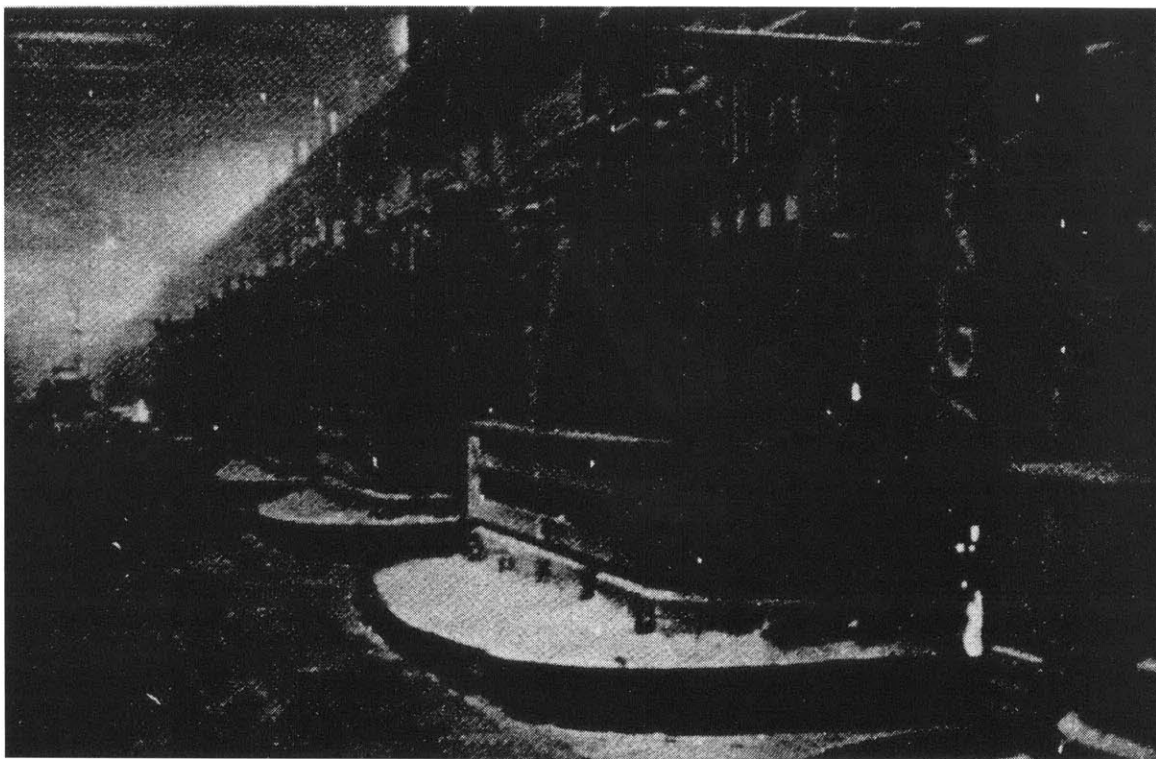


Figure A.20: Old Smelter in ZSNP

and, in 1970, manufacturing semi- finished aluminum products began, such as door and window frames for the building industry, venetian blinds, cladding, panel, tubes and aluminum wire and cables.

The aluminum production was located next to a town of Ziar nad Hronom, in the Central Slovakia. The region of Ziar nad Hronom was a center of traditional metallurgical activity. In the past, mining and metallurgical treatment of gold, silver and copper ores bloomed here. However, after the

local deposits of the ores were mined out and consequently metallurgical activity ceased, a new stimulus was needed.

In 1951, the Czechoslovak Ministry of Industry established the ZSNP (The Slovak National Uprising Works) as an integrated aluminum producer. It was designed as a key feature of the planned economy with a strategic intent to supply aluminum to defense industries. The former Soviet block planners pursued self-reliance in production of this strategic metal because they faced export embargo from the West. Also, geographical dispersion of production facilities to reduce strategic vulnerability of production in case of military strike was important; the production site was relatively distant from the Western European border.

Along with its strategic goal to supply military industry, the complex was built as a regional economic development project to bring industrial activity into a region with little job opportunities. The ZSNP has become the largest employer in the Ziar region with almost 8000 employees, its own housing development, and a medical center. It also gave rise to the town of Ziar nad Hronom. As a consequence of aluminum production and of a need to concentrate population, the Town of Ziar nad Hronom was built on a locality of a small village called Svaty Kriz nad Hronom. Unfortunately

for Ziar, the town was located in a direction of prevalent wind currents blowing away from the ZSNP.

Shortly after the start, impacts of aluminum production on environmental quality around the plant and on worker's health in the plant became apparent. As a consequence, various measures for correction were pursued by the Czechoslovak governments and the ZSNP management.

At the end of 1960's, an entire village closest to the ZSNP was relocated by a government decision due to the health risks to the inhabitants of the village. The valley of Ziar nad Hronom was classified as one of the most polluted localities in Slovakia and assigned a special management regime. On government direction, children in Ziar valley received free milk in schools and were sent regularly away on school trips to a clean natural environment (called school in nature). Further, all farm crops from the affected area in Ziar valley were redistributed to other parts of Slovakia while the Ziar valley was supplied with crops from the unaffected areas.

Also, different ways to add on air pollution abatement equipment on the smelter were considered. However, only limited primary emission control could be implemented due to design constraints in the installed Soderberg technology.

This technology was taking advantage of the heat in the smelting pots for concurrent baking of carbon anodes placed on the top of the pot. However, this very technological solution prevented covering the pots with hoods that would enable closed air circulation during smelting.

An alternative technological solution, based on the use of pre-baked anodes was studied for possible modernization of the smelter. As environmental conditions were increasingly deteriorating, the ZSNP management appealed to the state administration to authorize reconstruction of the smelter. Realizing seriousness of environmental deterioration caused by the smelter, the Czechoslovak Federal Government passed in 1968 a Resolution #172/69 on "significant reduction of emissions of fluoride and polyaromatic hydrocarbons in the ZSNP by the means of converting to the technology of pre-baked anodes." In 1970, the Slovak Government passed a similar measure, Resolution #304/70.

At first, a domestic technological design was pursued by research engineers. A new construction solution of the electrolysis unit was designed in the ZSNP and a pilot unit was built and tested in 1972. Consequently, plans for modernization of the potlines were drafted and submitted for consideration to the supervisory planning institutions - the State

Planning Committee, the Federal Ministry of Smelting and Heavy Engineering, and the Slovak Planning Committee. It was proposed that the reconstruction starts in 1977.

However, the concept of potline modernization began to change. In 1973, the ZSNP managing director wrote a letter to the Ministry of Smelting and Heavy Engineering about information he had obtained at the second Czechoslovak Aluminum Conference in 1972. In discussion with industry representatives, he was made aware of possibilities to acquire know-how from foreign aluminum producers. Consequently, letters of invitation to submit modernization proposals were mailed out to all the major industry aluminum producers: Alcoa USA, Reynolds USA, Kaiser USA, Alcan Canada, Pechiney France, Aluswiss Switzerland, Vereinigte-Aluminum Werke Germany and VAMI USSR. Three producers were selected for closer consideration: Kaiser, Alcan, and Aluswiss. A group of ZSNP engineers visited plants of the selected producers to see their designs first-hand. However, no contracts about know-how transfer were completed and ZSNP modernization was repeatedly postponed by the state administration.

At the beginning of 1980's, news of high current smelting pots begin to come to the ZSNP. This new generation of smelting pots was already controlled by computers. It became

apparent that the technological solution of the selected industry leaders from the 1970's was no longer current.

A Norwegian industry representative came on visit to the ZSNP who showed that his firm was able to prepare the modernization project. In the meantime, one of the ZSNP engineers, who went on the industry visits abroad a decade ago, was promoted to the position of a technical director in Kovohute Prague, the metallurgical industry headquarters. With his assistance and after repeated visits of Norwegian representatives, the state administration was finally persuaded that the modernization of the ZSNP production technology was urgent. On December 12, 1985, the Czechoslovak Government approved the decision #217 which proposed the modernization at Ziar. The modernization program envisaged the construction of a new alumina plant (Bayer technology), a new anode plant, a new smelter and a new casthouse. The existing "A" - smelter was to be closed and converted to the new cast house. The goals of the modernization were:

- reducing environmental damage by replacing Soderberg smelters with a modern smelter;
- increasing production from 70,000 MTPY to at least 108,000 MTPY (not including remelting of recycled aluminum);

- reducing energy consumption; and
- improving labor productivity.

Following the decision of the Czechoslovak Government, Kovohute Prague (the ZSNP headquarters), Ardal of Sundal Verk Oslo (later became Hydro Aluminum), and Polytechna Prague signed an agreement on March 20, 1986 about a transfer of know-how. At that time, the Norwegian technology was the most advanced in the industry, being the only one using a high current (220KA) smelting pot.

The modernization program was financed from ZSNP, Kovohute Prague and the Federal Ministry of Smelting and Heavy Engineering's resources. However, three years after the technical issues were settled and the modernization started, the financing of the project fell apart. In 1989, Czechoslovakia set out on the course of transition to market economy and political democracy. Most funding from the state sources dried up as the country struggled with the problems of transition and new policies towards the industry were adopted. Funding through the system of state planning agencies was no longer available.

As a response to the financing crisis, a consortium of banks including the Commercial Bank, Czech State Savings

Bank, Agrobanka, and the Investment Bank was put together to provide needed 500 million crowns for modernization. But the ZSNP management's attempt to secure financing from these domestic commercial banks failed at first because no credit guarantee for the loan was available either from these banks or from the state Finance Ministry. The ZSNP workers, frustrated by bleak prospects of losing their jobs, established a strike committee and threatened to cease aluminum supplies to all domestic enterprises with the exception of the pharmaceutical industry and sewage works. Their strike was to begin on October 26, 1990. Following the announcement of the imminent strike, a meeting was held in Prague between the workers, the management and the government representatives. For a short time following these events, further financing was arranged for through a series of syndicated loans from local banks led by Vseobecna Uverova Banka and largely guaranteed by the National Property Fund.

Although the workers strike surrounding the financial crisis was averted in time, another strike shook the ZSNP due to a political crisis. The workers went into a one hour strike on April 24, 1991 in protest over the allegedly undemocratic dismissal of former premier Vladimir Meciar by the Slovak National Council. An appeal signed by more than 5,500 of

7,000 ZSNP workers called for a reshuffle in the Slovak parliament presidium and for an early elections. Only 80 of Slovakia's 8,000 enterprises and organizations have joined the appeal. Vladimir Meciar, a leader of the Slovak separatists, returned later to the head of the Slovak Government to preside over the split of Czechoslovakia in 1992.

In the fall of 1991, the ZSNP was singled for privatization. The ZSNP as the legal successor of the state owned enterprise was transformed into a joint stock company by the decision of the National Property Fund of the Slovak Republic on August 6, 1991 and partially privatized in the First Wave of Privatization under the Large Scale Privatization Law of the former Czechoslovakia. But the financing crisis continued because most of the domestic loans were of considerably shorter term than required by the project's cash flow. To solve the financing crisis by gaining a longer term credit, the ZSNP initiated discussions with potential foreign investors.

Initially, the ZSNP management started discussions with Marc Rich & Co. AG. whose firm was interested in expanding its extensive metals and other commodities activities into the Central and Eastern Europe. A letter of intent was exchanged and some \$3 million was transferred to the ZSNP.

But the deal broke down when a campaign led by the AFL-CIO and British Trade Union Congress targeted labor groups in former Eastern Bloc nations to discourage them from doing business with Marc Rich & Co. The British labor unions staged shows of solidarity with the United Steelworkers union members locked out of Ravenswood Aluminum Corp. since November 1990, a plant allegedly controlled by the billionaire tax fugitive Marc Rich. As part of the campaign, the trade unions wrote a letter to the ZSNP calling the Marc Rich company "the worst of Western capitalism" and detailing Rich's 65-count indictment in the United States on tax evasion.

Following the breakdown of fairly advanced discussions between ZSNP and Marc Rich & Co. AG, HAL began to explore the possibility of investing in the modernization. In late 1992, under tight credit conditions in Slovakia and with historically low world aluminum prices, ZSNP's financing for the modernization program dried up. As a last resort, the ZSNP reverted all of its operating funds into the capital expenditure program in order to prevent demobilization of construction companies from building the new smelter. This desperate step brought the ZSNP at a brink of bankruptcy. The ZSNP stopped paying most of its contractors and suppliers and the debt service on its local bank loans. When construc-

tion effectively ceased in April 1993, the investment program was approximately 65% complete and \$185 million was already spent on the modernization.

Faced with the imminent bankruptcy of the ZSNP and its destructive effect on the regional economy, the ZSNP's management and the Slovak Government decided to carry out a fundamental restructuring of the ZSNP so that it was possible to obtain international financing to complete the modernization program. A leading role in the restructuring was played by the European Bank for Reconstruction and Development who approached the ZSNP with a proposal to assist with financing and reconstruction. The EBRD considered the project an important investment - the largest private sector loan undertaken by the Bank so far. In preparation of the project, the EBRD mobilized technical cooperation funds from the Dutch Government and the European Union's PHARE program to finance environmental studies of the ZSNP site.

The political liberalization that started in 1989 brought about change in the role of environmental groups. NGO's that formerly focused on issues of landscape and biological conservation become more active in a new role of pressure groups. While domestic NGO's such as the Union of Landscape Protectors reoriented themselves in their activity, they

were joined by international pressure groups who established local branches in the Czech and Slovak Republics. A new coalition of Greenpeace with the Union of Protectors of Nature was formed.

The ZSNP project did not escape attention of the new pressure groups. Greenpeace with the Union of Nature Protectors wrote an open letter to the President of the EBRD. The Washington based International Environmental Law Institute wrote another letter. The NGO's criticized the energy intensity of the plant and its perceived reliance on subsidized power prices. They also argued that financing of the project by the EBRD would contravene the Bank's mandate to promote environmentally sound and sustainable development. Another set of issues concerned the pollution and risks associated with existing electricity production facilities in Central Slovakia, which will in part be generating electricity for the SLOVALCO. Lastly, the status of public participation on this project was of concern.

The EBRD had to learn to respond to these letters and make environmental documentation available within the limits of confidentiality. Intensive discussion on mandate of NGO's vis a vis international development bank took place in trying to find the balance between private sector's need for

confidentiality and public's right to know about issues affecting it and involving the use of public funds.

As a major step in restructuring of the ZSNP, a whole owned subsidiary of the ZSNP, SLOVALCO a.s. was formed in 1993 at the advice of a retained management consultant. The objective of SLOVALCO's establishment was to take over the construction of the partly complete new smelter and ancillary facilities and to operate the smelter in line with western operating, control, accounting, and financial practices with management support from a strategic western industrial partner. Also, this transfer was made to insulate the new smelter from the largely unknown financial and legal liabilities of the ZSNP in a new legal entity and permit SLOVALCO to attract foreign capital at the level comparable to the leading western smelters.

Pending the equity investment by HAL and the EBRD, SLOVALCO's ownership structure was specified as shown in Table A.4: below.

Table A.4: Ownership Structure of SLOVALCO

	Equity	Control	Board Seats
ZSNP	80%	60%	3
HAL	10%	20%	1
EBRD	10%	20%	1

Table A.4: Ownership Structure of SLOVALCO

	Equity	Control	Board Seats
TOTAL	100%	100%	5

SLOVALCO's voting shares would be held by ZSNP, HAL and the European Bank in the ratio of 3:1:1. The board of the company would consist of five members, three nominated by ZSNP, one nominated by HAL and one nominated by the EBRD.

On July 1, 1994, SLOVALCO entered into an Asset Purchase Agreement and related agreements with the ZSNP under which it acquired title to the core assets and work in progress relating to the new smelter and ancillary facilities. On July 12, SLOVALCO entered into a Common Facilities Agreement with ZSNP under which it gained access rights over other facilities necessary to complete, start-up, and operate the partly completed new smelter. SLOVALCO was comprised of the following facilities:

- New smelter "C", including its ancillary facilities (power substation and the unloading station and silo's for alumina);
- New anode plant, including paste plant, baking furnaces and roding room;
- New cast house, excluding buildings and ground;
- Old cast house.

SLOVALCO also secured extensive easement rights over the ZSNP's land and facilities.

On July 12, 1994, SLOVALCO signed a sovereign guaranteed Loan Agreement with the European Bank for Reconstruction and Development providing for a loan of USD 110 million to finance the completion of the new smelter. Additionally to that the EBRD and Hydro Aluminum a.s. committed to make an equity investment of USD 15 million each in SLOVALCO. The Slovak Republic, ZSNP and its subsidiary ALUFINAL would be the Guarantors until the loan is paid back in 2003.

Early morning just before official signing of the loan, the Slovak Cabinet met to discuss the proposal that the National Property Fund undertake to guarantee the loan. The Cabinet agreed to pledge the shares of the ZSNP, which are owned by the National Property Fund, to the General Credit Bank Bratislava and to the Slovak Savings Bank. The pledged shares would cover the obligations of the National Property Fund as stated in the "Agreement on Guarantee Realization between the National Property Fund as the Guarantor, and the Commercial Banks as Creditors" dated October 27, 1993. The Cabinet also agreed that the National Property Fund signs the "Agreement on Financial Aid" with the EBRD, the ZSNP,

ALUFINAL, SLOVALCO, and HAL, and that it guarantees obligations included in this agreement.

The size of the Bank's exposure and the complexities of this project created unusual risk for the EBRD. For this reason, it carried out a particularly thorough analysis and consulted on all key aspects with world renowned outside experts - operating and capital costs, future business prospects, aluminum price forecasts, environment, and economic analysis. The project was also structured in a conservative way with significant contingencies and prudent capital structure, which made it financially resilient to unforeseen events. Agreements were reached with all parties, which could have a bearing on the success of the project and which were involved in about 30 different legal agreements to be signed before disbursements of EBRD's investment and loan.

The principal conditions of the EBRD loan were as follows:

- The syndicate of Slovak banks with outstanding loans to ZSNP agrees (i) to "stand still" on its claims against ZSNP for repayment of existing debt until SLOVALCO has operated successfully for six months and (ii) to permit ZSNP to transfer all project assets to SLOVALCO.

- Agreement from the National Property Fund that they will ensure the financial stability of ZSNP until project completion.
- HAL a.s. agreement to invest USD 15 million in SLOVALCO and to provide project completion, management and emergency repair services to SLOVALCO.
- Agreement from ZSNP to prepare and implement a restructuring plan.
- ZSNP to agree to a plan (the "Environmental Action Plan") for closing its two obsolete Soderberg hazardous smelters, alumina plants and brown coal fuelled power generation plant if they are proven not financially viable when operated in accordance with environmental and health and safety standards.
- ZSNP and the Slovak Republic agree with the EBRD on a plan to remedy all historical environmental damage and continuing sources of pollution identified in the EBRD's environmental audit, including "red and brown mud" waste dumps.

A critical Part of the project negotiation was the securing of market access for aluminum in the European Community. This was necessary because beginning in August 1993,

restrictions were imposed by the European Community on imports of unwrought aluminum originating in the 15 countries of the former Soviet Union. The process leading to the imposition of quotas began in February when French government asked that Community safeguard measures applied to aluminum imports. CIS imports to the west were reported to have quadrupled from 1990 to about 1 million tons in 1992 and further increases were possible for the whole year 1993. The restrictions took effect in spite of Russian authorities having denied dumping and arguing that the "restrictions on aluminum imports from Russia contradict numerous declarations of Community representatives about support for Russian reforms and trade liberalization." The European aluminum Association asked the European Commission to extend the quota in place until arrangement between the EC and the CIS is negotiated (ECE 1993, p.45). No similar quota was imposed on imports of aluminum from Slovakia.

A.4.1. Environment Development Interaction in Aluminum Plant Modernization

The ZSNP complex was identified as a major source of air and ground water pollution in the Slovak Republic and there was also some evidence of serious occupational health prob-

lems at the site. Environmental degradation caused by the ZSNP was a result of both an obsolete technology which did not allow adding on pollution abatement equipment, inappropriate environmental management practices, and inadequate equipment maintenance. Air pollution was caused by releasing high levels of sulphur dioxide, nitride oxides, fluorides, tars, and dust. Ground water contamination primarily originated from red and brown mud piles leaching caustic soda.

In the past, the ZSNP complex produced its own alumina using Soderberg and Bayer technology. During the manufacturing process, bauxite was digested with caustic soda to extract the alumina. About one half of the bauxite used in the Bayer process resulted in a residue product, red mud. This red mud still contained traces of harmful caustic soda. Because the ZSNP stored the red mud in an unsecured open dump, water penetrating the dump leached out this caustic soda and polluted ground water inadvertently destroying vegetation around the red mud pile. According to the loan agreement, the Bayer plant will remain in operation only if it is shown that it can be operated economically with all required pollution control measures. The red mud pile will be insulated by a bentonite wall and the soil around the pile

restored. If a decision is taken against producing alumina on site, it can easily be purchased on world market.

The Sinter plant produces a similar residue as the Bayer plant, called brown mud. The Sinter plant is regarded as at the end of its useful life. The mechanical condition of the equipment is poor and leads to an unacceptable environment for the operators. Nitrous oxide emissions and dust are very high leading to serious risks to occupational health. Operation of the Sinter plant has been stopped and will be closed down completely as a part of the ZSNP restructuring if no joint venture partner is found for its modernization. Some talks in this regard have been held with Raynolds, but no agreement has been signed as yet. The closure of the Sinter alumina plant would reduce substantially the amount of mud requiring disposal. The additional closure of the Bayer plant would mean no net increase in the size of the existing mud pile.

The structural condition of the existing smelters is also very poor. The potlines require considerable maintenance work and are based on outdated Soderberg technology. Emissions to the air from the existing smelters do not meet current and future environmental standards. Indoor and outdoor concentrations of a number of pollutants are at unacceptable

levels. The smelters are the main source of emissions of fluoride, poly-aromatic hydrocarbons (PAH) and tars and also generate significant quantities of sulphur dioxide and dust. Working conditions for the operators of the potlines create a serious health risk. Fluoride compounds affect the health of operating personnel and cause serious damage to vegetation. Continued exposure to high levels of fluoride affects bones and teeth. Exposure to poly-aromatic hydrocarbons (PAH) contained in tars is known to significantly increase cancer risk. The mechanical condition of a number of pots is such that the emissions of fluoride, PAH and tars are far above the normal levels for Soderberg pots. In accordance with the loan agreement, the three existing potlines will be closed as soon as possible. The shut-down of the existing A- and B- smelters, together with the start-up of the new C-smelter will have a major beneficial effect on air quality and occupational health and safety. Emissions of fluoride, tars, nitrous oxides, and dust will decrease dramatically.

The old anode plant produces high levels of sulphur dioxide, nitrous oxide and dust emissions during high temperature calcinating activities. Measures are being taken that will reduce emissions in the future. The old anode plant will stay in operation if it can be shown that it can be done

efficiently when implementing all the required pollution control measures. Also, parts of the old anode plant will be required in the production of pre-baked anodes for the new smelter.

The power plant which generates steam for alumina production and heat for the town of Ziar and the ZSNP complex meets Slovak emission limits which however will progressively increase in strictness until 1998. In the future, emissions, especially sulphur dioxide should be reduced by conversion to natural gas, by installation of desulphurization equipment or through adoption of fluidized bed technology.

To guarantee environmental improvements on the site, an Environmental Action Agreement between ZSNP and the EBRD was signed prior to disbursement of the loan. The ZSNP agreed:

- permanently to close Smelter "A" prior to first disbursement of Tranche A;
- permanently to close Smelter "B" no later than three months from the date of the start-up of the fifty cells at the new SLOVALCO smelter;
- permanently to close both alumina plants and the old anode plant within one year of the date of the first

disbursement under tranche B unless independent consultants selected by the Bank demonstrate to the satisfaction of the Bank that the relevant plants can be operated in an economically viable manner in accordance with environmental, health and safety standards acceptable to the EBRD;

- permanently to close down or to convert to gas operation the on-site power generation plant, subject to the same conditions as for the alumina plants and old anode plant.

Further, the ZSNP, SLOVALCO, the Slovak Republic and the EBRD agreed on an Environmental Remediation Agreement in which they specified detailed conditions and timetable for the containment of the red and brown mud pile and any other historic environmental contamination discovered in the environmental assessment and audit of ZSNP's and SLOVALCO's assets. If necessary, the Slovak Republic agreed to underwrite the cost of such environmental remediation. The financial obligations under the Remediation Agreement were linked to the cash flows from SLOVALCO. The taxes and dividends generated from the new production facilities will be used to finance this remediation. The cost of all remediation expenses, including desulphurization equipment for the

existing power plant is estimated to be less than US\$30 million.

Table A.5: below shows the atmospheric emissions, before and after the completion of SLOVALCO, for the entire ZSNP complex including the power plant.

Table A.5: Current and Future Emissions Released from ZSNP

	<i>current</i>	<i>future</i>
fluoride (t/y)	519	63
tars (t/y)	1,171	4
dust (t/y)	2,060	636
SO ₂ (t/y)	6,221	3,593
NO _x (t/y)	1,990	262

The completion of the SLOVALCO project and the restructuring of the ZSNP would bring the following benefits:

- avoid bankruptcy with the possible loss of over 5500 jobs;
- attract new capital and further privatize ZSNP and SLOVALCO;
- replace ZSNP's inefficient and polluting smelters and anode plant with a world class energy efficient smelter equipped with the best available pollution con-

trol technology;

- close ZSNP's inefficient alumina plants which produce environmentally hazardous waste by-products;
- obtain closure or conversion entirely to gas of the ZSNP's power station which is now primarily burning brown coal;
- contain the pollution flowing from the red and brown mud piles into the Danube River system;
- secure long term employment prospect in accordance with western practices for majority of the remaining workers at the site;
- develop a substantial Slovak company focused primarily on the export market that will generate hard currency earnings and become a significant local tax payer and source of environmental remediation.

Since the ZSNP loan was an industrial rehabilitation project with few new environmental impacts, project discussion focused primarily on economic and financial and strategic soundness of the investment. The main question raised in the discussion concerned whether the smelter should be mod-

ernized at all at such a high expense or rather closed down outright.

The critics pointed out that Ziar is not a prime location for an aluminum smelter because of inland location without deep water port, no access to cheap power, and no bauxite mine nearby. Prices of aluminum were at their record low and there already was production overcapacity in the world. The critics also saw modernization of the smelter as a continuation of the past ill conceived orientation towards heavy industry at the expense of service sector and consumer product sector.

The energy intensity of the plant and its perceived reliance on subsidized power prices were criticized. It was also stated by a number of NGO's that the proposed financing by the bank would contravene the Bank's mandate to promote environmentally sound and sustainable development.

The project proponents believed that in spite of the above points, the project was still financially, economically and strategically viable according to their analysis. They prioritized major competitive factors for aluminum smelters in the following order:

- alumina, power and labor costs, which together account

for around 70% of the total cash costs;

The company would be at a significant disadvantage on alumina costs since inland freight would add transport penalty to each ton of metal produced. Electric power costs would also be higher in comparison to average cost of other smelters. However, even with aggressive wage and salary increase policies, the company would gain significant cost advantage on labor cost which are below average worldwide labor costs.

- the quality of the smelting technology, which can significantly increase the power and labor consumption;

The HAL technology to be employed by SLOVALCO, which consumes 13,200 D.C. kWh per ton compared to the Western world average of about 15,500 D.C. kWh, gives it a power cost advantage and decreases consumption of all inputs other than alumina.

- market position, including advantages in terms of freight costs, scrap availability, and captive customer;

Ziar is well located in Central Europe, on the edge of major markets. Taking into account freight costs to projected customers and the freight cost of the likely competition, SLOVALCO gains from its locational advantage. Also, SLOVALCO benefits from having primary aluminum source next to casthouse because it may possibly use thermal energy of liquid aluminum for remelting without additional energy and it will not lose metal due to oxidation.

- capital costs, which if poorly financed can impose a significant cash drain on the operation.

The net sum of penalties and advantages quantified and compared in competitiveness analysis showed that SLOVALCO's smelter would have operating cash costs well within the first quartile of the aluminum industry.

However, the financial viability of the project depends not only on its operating costs, but also on characteristics of the aluminum market in which products are sold. The aluminum market is characteristic by chronic imbalances in supply and demand due to the commodity nature of the product and the lead times required to adjust capacity levels to demand. The

important characteristic of the aluminum market is that a producer can always sell commodity ingots to a broker at the prevailing LME price.

Demand for aluminum is expected to increase in the West from the transport, packaging and construction sectors. In Eastern Europe, demand is expected to come mainly from infrastructure development and the construction sector.

Future supply, and therefore inventories, are a function of new capacity being brought on stream, existing capacity being shut down and of future imports from the FSU. Because prices were so low at the time of loan preparation, it was expected that only limited new capacity would be started up. Closures of existing capacity were already occurring because of the low prevailing prices. The Russian exports were the wild card. Because of the desperate need for hard currency earnings, the main view was that the FSU would try to maintain its high level of exports even though it implied continuing catastrophic damage to the environment, as well as a shortage of supply of aluminum to local industry.

The world price of aluminum, like price of many commodity products, has historically been cyclical. The evolution of aluminum prices depends on the growth rates of the major economies, production capacities around the world, stockpil-

ing, the volumes of exports from FSU producers and consumption patterns from aluminum products. Aluminum prices at the time of the project preparation were the lowest that they had been in the 130 year history of the aluminum industry. The situation resulted from combination of two events, one normal, the other not. The normal event was the world wide recession which slowed down the growth in demand for aluminum and semi-finished aluminum products. The abnormal event was the collapse of the FSU and that of its domestic markets for aluminum which has triggered a continuing and unprecedented stream of exports to the West.

The internal rate of return of the project was calculated taking into consideration the main variables that are likely to affect the SLOVALCO's returns - the operating costs, capital costs, product price, production volume.

The project proponents argued that while it is true that the proposed smelter, like any other smelter, will be a large consumer of power, it should be stressed that it will be among the most energy efficient smelters in the world. Also, they argued, it will only consume 10% more power than the existing smelters. As to the reliance on power subsidies, the project proponents did not believe that the prices charged to ZSNP and to SLOVALCO represented an unfair sub-

sidered in view of the large requirements for power and the stable load the smelter represented. An economic analysis was carried out assuming different power prices ranging from the contractual price of 3 cents per kWh to 5 cents per kWh which was at the very end of the estimates for the economic cost of power. The economic rate of return, even under the most conservative assumption, was calculated satisfactory demonstrating in the view of the project proponents that under any reasonable scenario about power costs and future aluminum prices the project represented an efficient and economically justified use of resources.

The economic analysis was based on a number of key assumptions. The economic cost of power was defined as the cost that Slovakia could avoid if the new smelter were not completed. In the calculation, the contract price and an estimated marginal cost of power in Slovakia were used.

Next, the capital expenditure incurred so far were assumed to be irrelevant in the decision because they had already been incurred (sunk cost). Another important assumption used in the economic analysis was the economic shadow cost of labor and the opportunity cost of capital to Slovakia.

Given these assumptions, a base case and a worse case ratio for economic rate of return were calculated for a range

of energy prices. The calculation did not include an estimate of the actual environmental costs associated with the project, particularly the waste disposal costs. However, these costs would probably be compensated by the economic benefits to Slovakia of an indigenous aluminum industry. A major consideration in the strategic decision to allocate resources to modernizing the smelter was the importance of local supply of metal to the predominantly metal-manufacturing industries in the region, ranging from automotive to aerospace. Proximity to users in these sectors is important in a number of ways, including savings in transport costs and inventory carrying costs. Furthermore, interaction between supplier and user of metal results in the development of more tailored specifications for the metal, which can be an advantage in the manufacture of precision cast aluminum products like pistons which are increasingly in demand for the western European automotive industry.

The project proponents believed that returns to the economy would be substantial because, with a limited incremental investment, the project would dramatically improve the efficiency and capacity of the existing aluminum operations at Ziar and will allow ZSNP to restructure its activities and return to profitability. Not completing the smelter would

most likely result in a write-off of USD 185 million of capital expenditure with no possibility for the local banks or the National Property Fund to recover the funds which financed these expenditures. It would result in the cessation of an industrial activity in which the Slovaks have built over 40 years significant expertise and for which all necessary infrastructure is in place. It would also mean that ZSNP would never be in a position to repay its existing debt and restructure its other operations.

Appendix B:

INVESTMENT ACTIVITIES OF MULTILATERAL BANKS IN THE CZECH AND SLOVAK REPUBLICS

B.1. IBRD signed projects¹

CSFR - Structural Adjustment Loan	1991	\$450M
CSFR - Power and Environmental Improvement Project	1992	\$246M
CR - Telecommunications	1993	\$80M
SR - Economic Recovery	1994	\$80M

B.2. IFC signed projects²

Cementarny a Vapenky Mokra A.S.	1992	\$17.2M
Zivnostenska Banka, a.s.	1992	\$6.4M
C.S. Cabot Spol.sr.o.	1993	\$20.3M
O.B. Sogelease A.S.	1993	\$0.6M
O.B. Heller A.S.	1993	\$0.2M

1. source: World Bank Annual Report 1994

2. source: IFC Annual Report 1994

Autokola Nova Hut a.s.	1994	\$16.2M
MAFRA, a.s.	1994	\$14.20M
Vetropack Moravia Glass, a.s.	1994	\$19.50M

B.3. IFC Technical Assistance and Advisory Services

Skoda Pilsen

Grand Hotel Pupp

CKD Kompresory

Elitex Usti

Elitex Chrastava

First Brno

Kavalier Glassworks

Prague International Air Terminal

B.4. EBRD signed projects¹

Czech Republic

Czech Investment Corp.	1991	ECU 7.46M
Cokoladovny	1991	ECU 24.10M

1. source: EBRD Annual Report 1994

CSA	1992	ECU 20.80M
Eurotel Prague	1992	ECU 9.08M
CZ - Cagiva, a.s.	1992	ECU 8.39M
Skoda Automobilova/Volkswagen	1992	ECU 102.27M
Telecom Project	1993	ECU 72.45M
TFP: Komerčni Banka	1993	ECU 53.78M
Thurn Taxis Dobrovice	1993	ECU 4.14M
Praha Hyatt Regency Hotel	1993	ECU 17.44M
Kabel Net	1994	ECU 8.5M
Karosa - Renault Vehicules Industriels		
Joint Venture	1994	ECU 37.00M
Barum Continental	1994	ECU 30.6M
Eurotel Prague/Expansion Finance	1994	ECU 3.3M
Tesla Y.S., a.s.	1994	ECU 6.0M
Corfin Credit Line	1994	ECU 24.5M
Technolen WF a.s.	1994	ECU 8.9M
Investicni a Postovni Banka a.s.	1994	ECU 40.8M
Ceske Drahy - Czech Rail Corridor	1994	ECU 42.5M

Slovak Republic

Eurotel Bratislava	1992	ECU 6.60M
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Slovak Telecom Project	1993	ECU 44.00M
Slovenska Polnohospodarska Banka	1993	ECU 4.60M
Sloveca Joint Venture	1993	ECU 5.17M
International Road Corridor	1993	ECU 15M
ZSNP	1993	ECU 112.04M
Slovak Trade Facilitation Project	1993	ECU 53.78M
Tatra Bank	1993	ECU 3.35M
Slovnaft a.s. Loan	1994	ECU 24.5M
Tatra Bank Credit Line	1994	ECU 15.9M
Slovnaft a.s. Equity	1994	ECU 48.9M

B.5. GEF

Czech Republic

TA for the Phaseout of Ozone Depleting Substances	1994
Biodiversity Protection Project	1994

Slovak Republic

Biodiversity Protection Project	1994
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